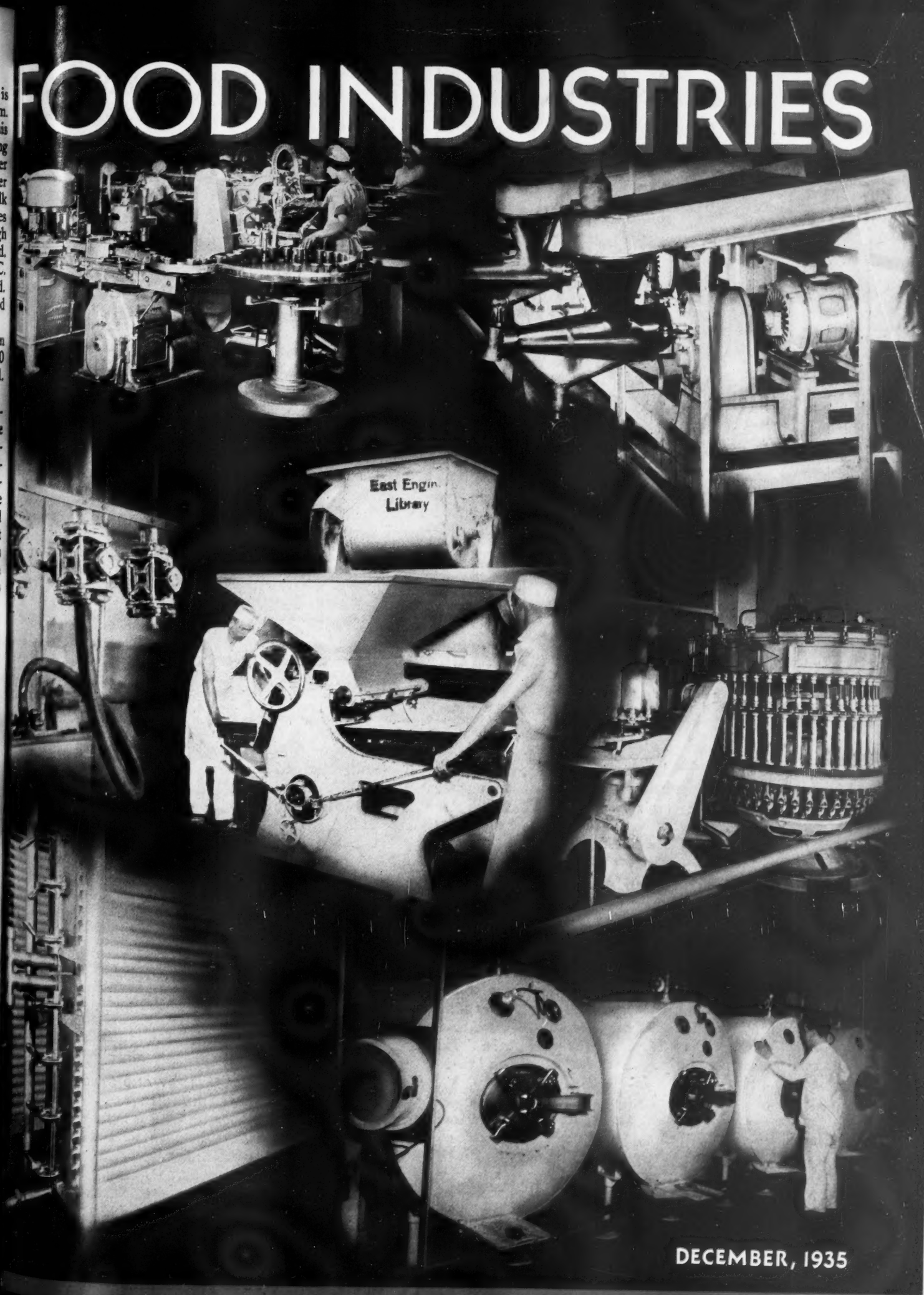
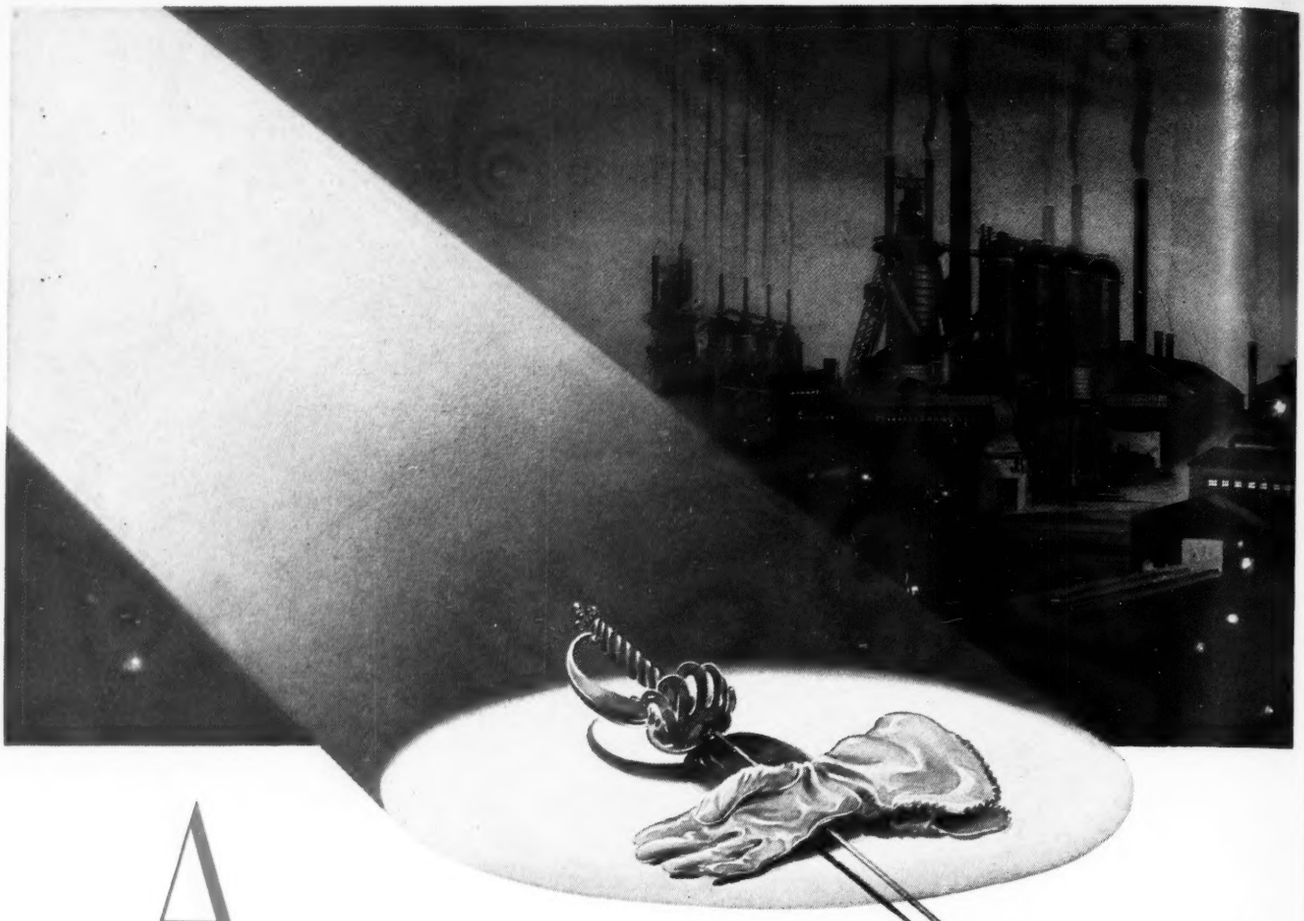
FOOD INDUSTRIES



DECEMBER, 1935

MATERIALS OF CONSTRUCTION NUMBER



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FOOD INDUSTRIES

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FOOD INDUSTRIES

PRODUCTION • ENGINEERING • DISTRIBUTION

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Vol. 7, No. 12

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Laurence V. Burton, Editor

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DECEMBER 1935

THE TALK OF THE INDUSTRY

PITY the dejected hopes of the chap who was getting up a recent exhibit of bread from foreign countries, in the expectation that American bakers might derive considerable inspiration and new ideas from the display. The first foreign bread to arrive came from Caracas, Venezuela, wrapped in transparent cellulose with a Mickey Mouse band around the loaf.

SOMETHING that will sound suspiciously like raucous guffaws will arise in the majority of the meat packing plants of the land when the Supreme Court hands down its decision on the constitutionality of A.A.A. In fact we have already heard a few audible smiles in anticipation of that event.

It appears that here and there are a few meat packers who are so cocksure the processing taxes will be declared unconstitutional that they have omitted all efforts to try to collect them. And naturally these few can undersell their competitors who still try to pass the tax along to the consumer. But if the tax is declared constitutional, those who have been evading collecting it will be liable for the full amount and will not have it on hand. And, if the tax is declared unconstitutional, those who have been collecting it and paying it into escrow, figure that the entire sum so collected will belong to the meat packer and will represent clear profits—profits that the non-collector has already given away.

PACKAGING NOTE: A situation paralleling the "Industrial Crisis" made famous by cartoonist Gluyas Williams occurred a few weeks ago on the dining car of a special train. This train was enroute to the sales convention of a concern that makes glass bottles.

Imagine the reaction of the bottle makers to the ad of the Premier-

Pabst Corporation on the special convention menus, when it extolled the virtues of Pabst export beer in these words, "Enjoy real brewery goodness sealed in the Keg-lined Pabst Tapa-can."

LIFE grows more complex every day, even for dogs. John Morrel & Co., is now manufacturing dog food in three "diets"—A, B and C in recognition of the possibility that dogs may tire of a single flavor. Diet A is beef; diet B is fish; and diet C is cheese.

What if this variety of flavors so stimulated the appetites of dogs that they ate enough to make themselves fat? Corpulency is more of a social liability for dogs than for people.

THE much looked for "Allergy Dinner" at the fall convention of the American Dietetics Association in Cleveland petered out because the hotel management failed to get sufficiently enthusiastic about it.

Perhaps the chef was not quite equal to the task of eggless, wheatless, milkless, etcetera-less meals. One suspects that his reaction might have been like this department's when we were mess officer on a hospital ship in 1918. A fully qualified medico ordered a diet, on that never-to-be-forgotten voyage, that was free from protein, carbohydrate and fat.

P. S. The patient was not fed.

SPEAKING of the wicked food manufacturer and his exploitation of the simon pure common man, what ought to be done in the case of Swift & Co.? Here is a concern that has begun to give its time-clock employees a yearly vacation with pay!

If manufacturers keep on exploiting people in this manner, this department cannot accept the responsibility for the outcome.

Back in our own time-clock punching days with a seven-day week and a twelve-hour day, we never knew the meaning of the word "vacation," "week-end," or "day of rest," let alone their enjoyment.

A day's work was a day's work in those days.

ONE of the most popular items at the recent convention of the American Bakers Association was the heavy gold badge denoting that the wearer was the Mayor of Kansas City, Mo. The badge belongs to Bryce Smith who is in charge of the Kansas City branch of General Baking Corp., and likewise is mayor of the town. Somehow we can't quite decide whether the mayor of Kansas City is employed by the bakery or whether the city employs the man-

ager of General Baking. It's all very confusing.

United Front Again Needed

MOST food manufacturers think it would be a good thing to have the Copeland Food and Drug Bill enacted during the coming winter. They believe that the somewhat more rigorous regulations so provided would do enough good for honest manufacturers to offset the certain extra burdens of closer control by the Department of Agriculture. Furthermore, they believe that the public is entitled to some additional protection which is not accorded by the old law.

Within official circles there is a like desire for some new law; but rumor has it that hard feelings have been stirred up among the officials as to how rigorous the new law must be in order to be satisfactory to them. One Washington report has even gone so far as to claim that Tugwell was about to fire W. G. Campbell, chief of the Food and Drug Administration, because Campbell had agreed to a reasonable set of modifications of the Copeland bill.

It is well known that Tugwell's ambitions in this direction are much greater than those of the career men who know some of the things that can't be done as well as some of the things that should be done. But we do not believe that even the Under Secretary is quite so foolish as to allow differences on this point to lead to the removal of a man like Campbell, whose years of experience are invaluable in the vigorous but fair administration of the Food and Drug Law. The Under Secretary could find no more certain way completely to wreck the morale of his professional staff than such a dismissal.

It's Better to Accept

INVITATIONS from Major George L. Berry to come to Washington on Dec. 9 to confer on a revival of NRA leave many a manufacturer cold. Should one accept the invitation or should one decline it?

In our opinion the decision should be based on reason and not on emotion. While all may feel like telling Major Berry that his letter has been filed in the waste basket, we believe that it is better to go to Washington, occupy all the visible seats, and act positively rather than negatively.

Major Berry is a vastly different personality than was General Johnson. Few industrialists outside of New York City ever heard of the man before. It would be well for all to get his measure and study his style of pitching. Berry is shrewd, very, very clever, powerful, ambitious and prefers to work behind the scenes.

Profits

ALTOGETHER too many persons speak glibly about the evils of the "profit system" without knowing exactly what they mean.

What are profits? When does a profit begin? Is profit for the individual any different in character from profit for a corporation or a business?

To our way of thinking, individuals profit as much as businesses—probably more. Anyone who takes in more than enough to cover the bare necessities for existence is making a profit of a sort. And we cannot believe any individual sees any evil in that.

For the Pure Only

HOW to combat governmental "fishing expeditions," delving into a corporation's private affairs, appears to have found an unexpected answer in the recent experience of a Chicago concern. When the investigators returned for a second fishing expedition, the manager became so enraged that he called in representatives of the daily press.

It so happened that a cub reporter blundered prematurely into the office during the lunch-hour, found the investigators and interviewed them during the manager's absence. When the government men discovered what was afoot, they berated the manager roundly. He countered by stating that there was nothing in his business of which he was ashamed—that the daily press had as much right to information as the Senate of the United States.

But the investigators hastily gathered their belongings and left before the hour appointed for the appearance of the other reporters. And the investigators never came back!

". . . and Statisticians"

EVERYBODY has heard about the three kinds of folks ranging from liars to statisticians. The latter group got in their good work for the "benefit" of the consumer during last month in Washington. They changed the base which underlies price indexes, so that the rising cost of food will not look as bad as heretofore.

FOOD INDUSTRIES has been accustomed to publishing data from these government sources as an index to trends in the economic factors affecting our manufacturing business. But if fundamental statistics are to be used as political ammunition, we begin to wonder whether even charts of supposedly impartial data mean so much any more.

If interested New Dealers in Washington think this is going to make Mrs. Housewife any less conscious of the greater financial burden on the market basket, they are fooling only themselves. Artificial factors which boost food prices needlessly will be boomerangs. And it will be the New Deal which will get the black eye.

The Old Problem Again

HOW to make a profit in 1936 will be just as much of a problem as it was in the dark days of 1932.

In 1932 the problem was to lower costs fast enough so that the ever-diminishing selling prices could not quite wipe out the profits.

In 1936 the problem is to discover ways to keep the ever-increasing costs from catching up with the rising selling prices.

Sales departments will be doing their best to get more for your products, but salesmanship is not the whole answer to profits. It is up to production men to produce goods that are of the right quality at the right cost, or the sales department cannot do all that is expected.

Low cost manufacturing is just as important today as it was four years ago. For those who are seeking new ideas and new points of attack on this problem we recommend a visit to the Chemical Show in New York, Dec. 2-7.

Not only will you see the latest offerings of equipment that can be used in food processing but, what we consider to be even more important, you will gather ideas by swapping yarns with the men who are there. No one can spend a couple of days at Grand Central Palace without coming away greatly inspired.

Important if True

SO the so-called breathing spell for business is to be prolonged indefinitely? This pronouncement by Secretary Roper at the A.G.M.A. Convention comes under the category of important if true and, likewise, as long as it is true.

★ ★ ★ ★ ★

Choosing the Right Material

IT may sound fantastic to the uninformed, but it is none the less true, that many foods which can be eaten with pleasure and satisfaction by any one may also possess the power to destroy concrete and steel.

It is also true that people can work with impunity for years in an atmosphere in a food plant that will cause steel window sash to corrode away or some kinds of paint to disintegrate.

And unhappily it is also true that a piece of equipment which may not be visibly affected by a food with which it is in contact may nevertheless so affect it that the value of the food is nearly totally lost. Such a loss may be caused by color changes, by flavor changes, such as bitterness or tallowiness, and by the formation of precipitates and sediments in liquids.

It is possible for a material in a piece of equipment to be of a character that will harbor microorganisms which later will contaminate and ruin a food. Yet from every other standpoint it may be a perfect material.

Trouble of other types can arise. Equipment can be made that is seemingly perfect, yet it may not be able to withstand the action of the necessary cleansers or cleaning operations. Or it may be of a material that necessitates the use of special compounds in its fabrication, compounds that, though present in but relatively small quantities, will do harm to the food product.

A material may be of such low physical strength that the cost of the requisite amount for a job is too great to be economic. Or its rate of heat transfer may be in a range that is not usable to good advantage. In such cases, will the coated, lined or "clad," materials solve the problems?

To go even farther, a material and method of fabrication may be specified that cannot possibly be made into a satisfactory unit by that method because of the peculiarities inherent to the material.

Problems, such as the foregoing samples, are only a very few of the things that come under the general heading of choosing the proper materials of construction. The equipment fabricator does his utmost to provide the right material for the user. But sometimes the user may be reluctant to pay enough to get the right material. Then what?

WHAT are the probabilities of satisfactory service if a user is overly economical or if he insists on a material that was satisfactory ten years ago but should be replaced to advantage by another material today? Even in the centuries of experience that lie back of the food industries the answer to all problems has not been found.

A solution of a construction problem that was satisfactory yesterday is made unsatisfactory today by new materials Obsolescence of materials occurs none the less surely than obsolescence of equipment, methods and ideas.

The job of the food engineer differs but slightly from the job of the chemical engineer in choosing the right materials of construction. Although the chemical engineer is not always concerned with what the material will do to the product—especially in heavy chemicals—the food engineer cannot overlook the possibility of adverse effects for a moment. It is ever a paramount consideration.

Only by combining the best knowledge of the food processor, the food chemist, the material maker, the fabricator and the designer, both of buildings and equipment, is it possible for the food engineer to arrive at the best adaptation of plant and equipment to the job to be done.

TO facilitate that end FOOD INDUSTRIES has gathered all the available pertinent data on metals, plastics and wood, presenting it in tabular form in this, its first materials of construction number. The tables are supplemented by brief discussions on some of the more commonly used materials.

As far as we know such a collection of data has never before been assembled for the food industry, and we acknowledge our debt to the material makers who have so generously supplied the data.

Iron and Steel

They continue to be the most important materials of construction for the food processor

WITH the advent of new corrosion-resisting alloys during the past 25 years, and the consequent heightened interest in problems of corrosion resistance, many plant executives and engineers tend to disregard the importance of iron and steel. Nevertheless, it is still true that ordinary iron and steel remain the most important metallic materials available for the construction of food processing equipment and the structures in which it is housed.

Cast iron, wrought iron, commercially pure iron, and the various grades of low carbon or mild steel constitute the bulk metals of the machine designer and building constructor. Cast iron in the form of machine parts, machine frames and bases, drains, piping, fittings, valves, curbs, and other accessories has wide application.

Wrought iron, once almost discarded except as a material for piping, has undergone a distinct revival during the past six years. According to A. M. Byers Company of Pittsburgh, Pa., wrought iron now appears as roofing and siding of buildings; and is used for the construction of many items of plant equipment, including tanks for molasses, syrup and sugar; meat cooking tanks; yeast tanks; juice settling tanks and troughs; milk can troughs; bake oven linings; hog dehairing tank linings; water storage tanks; stacks, breechings, coal chutes, and hoppers. As pipe, wrought iron is used for steam, water, and gas lines; for ammonia and brine systems; and in condensers.

Commercially pure iron is generally used in sheet form. It enters building construction as roofing and siding, and, as the base of enameled sheet, forms a part of much processing and accessory equipment.

Ordinary steel is the backbone of most modern factory building construction. Whether as the reinforcing rods of the monolithic concrete structure, or as the beams and girders of the more usual masonry-type building, steel is the principal dependence of the builder for strength and rigidity. It is also used widely for doors, windows, and frames.

Steel is also employed in many ways in the construction of processing equipment and accessories. Parts of equipment, pipelines, valve parts, pipe fittings, power equipment, materials handling equipment, tanks and containers, hoods, ducts, flues, chutes, hoppers, bins, shelves, baking pans, oven parts and many other things of common use are made of this metal.

ONE fact to be kept in mind concerning the use of iron and steel is that these metals are corroded at a relatively high rate. Moist air, water, brines, food acids, and some cleaning solutions are among the common corrosive agents attacking iron and steel. Because of this corrodability, these metals should be protected, when exposed to attack, by some suitable coating.

Long before corrosion-resisting steels, or the newer non-ferrous alloys, were available, this problem of iron and steel corrosion led to the development of effective protective methods, now supplemented and enlarged by new technics. Sheets, plain or corrugated, and piping have long been galvanized, or hot-dipped in zinc, as a means of preventing moist air, fumes or water from attacking the iron. This is an effective method for parts not in contact with food; but zinc should never be allowed to contact with foods, as it readily dissolves and its effect is toxic. Zinc may safely come in contact with water that enters food, as it is not soluble in water.

Iron and steel in contact with foods should be protected by indissoluble, non-corrosive coatings. One of the familiar types of such coatings is porcelain or glass enamel. More recently, coatings of the synthetic resin, or plastic, type, such as glyptal, have come into use. For many purposes, coatings of pitch-like substances or rubber give good results. Tin, which has been used as the protective coating on such vast numbers of food containers, is also used as a protective coating on metal in contact with foods. Another form of coating has been developed in the "clad" metals, in which a thin sheet of nickel, stainless steel, or other metal is welded to a steel backing in order to provide a suitable surface on the working side of the equipment.

Cast iron, being to some extent protected on the surface by silicon-iron alloy formed in the process of manufacture, can be used in contact with food ingredients, the corrosive agent of which is a weak organic acid, without other protective coating. But, it should be kept in mind that *only the cast surface of cast iron is protected in this way,* and machined or ground surfaces will be readily attacked.

This need for coating iron and steel surfaces in contact with food arises not only from the necessity of protecting the surface against corrosion in order to avoid destruction of the metal, but also because iron is readily soluble in many food acids and ingredients and metallic contamination results. Iron contamination does not detract from the wholesomeness of the food, but often spoils the appearance, color, or flavor.

Coating of iron and steel not in contact with foods, when not done with zinc, is accomplished by means of suitable paints, lacquers, or enamels. These are available in wide variety, both as to performance and color; and it is easily possible for the plant manager to select coatings of this type which will protect the metal from attack, if properly applied and maintained in good condition.

TO sum up, ordinary iron and steel are, and will continue to be, the chief metallic materials of the food processor, because of relatively low cost, ease of fabrication into any desired form, strength, and availability of methods for preventing corrosion and food contamination. The physical and chemical properties and characteristics of commonly available forms of iron and steel will be found in the table on page 601 of this issue.

Tanks and covers of 18-8 stainless steel in the Los Angeles Coca Cola plant maintain their contents free from metallic taint or other impairment.

Steel Alloys

Stainless steels of the 18-8 type give satisfactory results in food processing where metal comes into contact with foods

By WALTER M. MITCHELL
Metallurgical Engineer, Subsidiary Companies, United States Steel Corporation, New York, N. Y.

EVALUATION of a metal to which foods will be exposed in the course of their preparation, from the hygienic standpoint, involves not only such obvious considerations as the length of exposure to the metal and the temperature at which this occurs, but also the chemical characteristics of the food itself, especially the content of acid of salt, and the presence of dissolved oxygen. These factors determine the reactions between the food and the metal, and these reactions must be zero, or at least a minimum, before recommendation of the metal can be made with proper assurance of safety.

Not only must the metal be immune to attack from foodstuffs and satisfactory from the hygienic standpoint, but it must also be available in all necessary forms for manufacture of equipment. Further, it must have such properties of ductility, strength, weldability, etc., that all required fabrication can be accomplished at a reasonable cost. Finally, the metal itself must be reasonable in price so that its use can be universal.

Among the various metals that have been used for food handling equipment, stainless steels have satisfactorily met the above requirements, and, in consequence, are now generally approved for all kind of food handling equipment. The most important of these from the standpoint of its usage in food industries is the steel containing 18 per cent chromium and 8 per cent nickel. Popularly it is known as "18-8." In "18-8" are combined the desirable corrosion resisting qualities of chromium and nickel, and there is produced an alloy of excellent strength and toughness, with high ductility, and which may be fabricated by any approved fabricating methods.

The composition of this steel lies within the range of 17 to 20 per cent chromium and 7 to 12 per cent nickel, with low carbon. Typical physical properties of "18-8" steel in the heat treated (ductile) condition are given in the following listing:

Ultimate strength—80,000 to 95,000 lb. per sq.in.
Yield point—35,000 to 45,000 lb. per sq.in.
Elongation in 2 in.—55-60 per cent.
Reduction of area.—55-65 per cent.
Izod impact strength—75-100 ft. lb.
Brinell hardness—135-185.
Rockwell hardness—75-95 B.
Specific gravity—7.90 (average weight 0.286 lbs. per cu.in.)
Specific heat—0.12 B.t.u. per deg. F. per lb.
Thermal conductivity—113 B.t.u. per sq. ft. per hr. per deg. F. (per in. at 212 deg. F.).
Coefficient of thermal expansion—0.0000098 per deg. F. from 32 deg. to 212 deg. F. (about 1½ times that of low-carbon steel).

Stainless "18-8" has three outstanding characteristics which are especially pertinent in food handling equipment: (1) non-corrosive properties, (2) light weight in fabricated forms, because its high strength permits the use of thinner gages, (3) permanent bright and clear appearance.

LABORATORY tests were originally made to determine possible reactions between "18-8" and various foods under customary conditions of food preparation. These tests were conducted with two purposes in view: First, the action of the foodstuff on the metal, whether corrosion might occur or not, to estimate the probable

life of equipment and the economy of installation of equipment fabricated from such metal; second, the more important question of determining whether contamination or deterioration of the food might occur through absorption of metallic salts with resulting impairment of taste and nutritive value. These tests were made by boiling various foods for various periods in containers made from "18-8" steel. To simulate further actual usage the foods were stored, after cooking, in the same containers in a refrigerator for 72 hours.

Careful weighing of the containers before and after the test showed negligible losses in weight and indicated indefinite life for the stainless equipment. However, the factor of greatest importance from the hygienic standpoint is the presence of metallic material which might be dissolved from the containers and thus contaminate the food. In each case, after cooking and storing, analysis was made of the food to determine dissolved metals or metallic salts. The analyses showed only the most minute traces of dissolved metal and this consisted chiefly of iron (Titus, Elkins, Finn, Fairhall and Drinker). The quantities thus detected were so minute that from the hygienic standpoint their presence can be disregarded entirely.

Biological tests have also been made with milk and dairy products in stainless steel containers to determine any evidence of possible cumulative action in the human body of minute quantities of metals which might be dissolved over a long period of time. The results were entirely negative and showed no evidence whatever of cumulative action. (Conn, Webster and Johnson.)

The availability of "18-8" stainless steel in all commercial shapes and sizes and its fabricating qualities make possible the design and ready construction of processing equipment, such as sorting tables, mixers, jacketed kettles, boilers, washers, and grinders. Extensive stainless equipment has been installed in the larger and more important canneries for processing vegetables and fruits. The permanent nature of "18-8" makes this equipment economical because maintenance and repair costs are reduced to a minimum.

Tests have disclosed that some metals have a distinctly deleterious action on foodstuffs, particularly copper and copper alloys which have been shown to have a destructive effect on vitamins when in contact with foods heated for processing. This does not occur with "18-8."

THE preparation of fruit juices and similar "soft" beverages may now be classed as a major industry. Stainless "18-8" is now standard for equipment for preparation of pineapple juice, grape juice, orange juice, loganberry juice, bottled sodas, tomato juice, and sauerkraut juice. The availability of seamless drawn tubing, polished on both inside and outside surface, makes the handling and bottling of such products under sanitary conditions an easy matter.

Transportation of beverage syrups and fruit juices in bulk is now conducted in drums made of "18-8," which have supplanted wooden barrels and have the advantage of compactness and durability and afford perfect protection for the contents, even during long periods of storage.

The handling and processing of highly acid and corrosive products, such as brines and other mixtures containing vinegar and salt, has always been a difficult matter. There are few commercial metals that will successfully withstand the vinegar-salt combination in pickles, relishes, mayonnaise, salad dressings, green olives, ketchup. Notwithstanding the corrosive character of these combinations, they are successfully handled with "18-8"; but, on account of the unusually corrosive nature, precautions must be observed to wash and rinse thoroughly all equipment after use, otherwise pitting may eventually occur.

Other applications are for machinery and equipment for the dehydration and evaporation of fruits and vegetables; and for the preparation of evaporated and condensed milk, infant foods, condiments, flavoring extracts.

In abattoirs, packing and slaughterhouses and in butcher shops where fresh, frozen, salted, and smoked meats are handled, equipment made from "18-8" is giving entirely satisfactory service. Table tops, racks, pans, troughs, meat hooks, and boiling kettles made from "18-8" withstand attack from all packing-house products, and vastly simplify the maintetance of sanitary conditions which are so important in this industry.

The handling and canning of fish and sea foods must be done under strictest sanitary conditions, for there are few foods so easily spoilable or so injurious to health when spoiled. The use of "18-8" eliminates entirely the dangers of contamination from wooden tables, boxes, and crates.

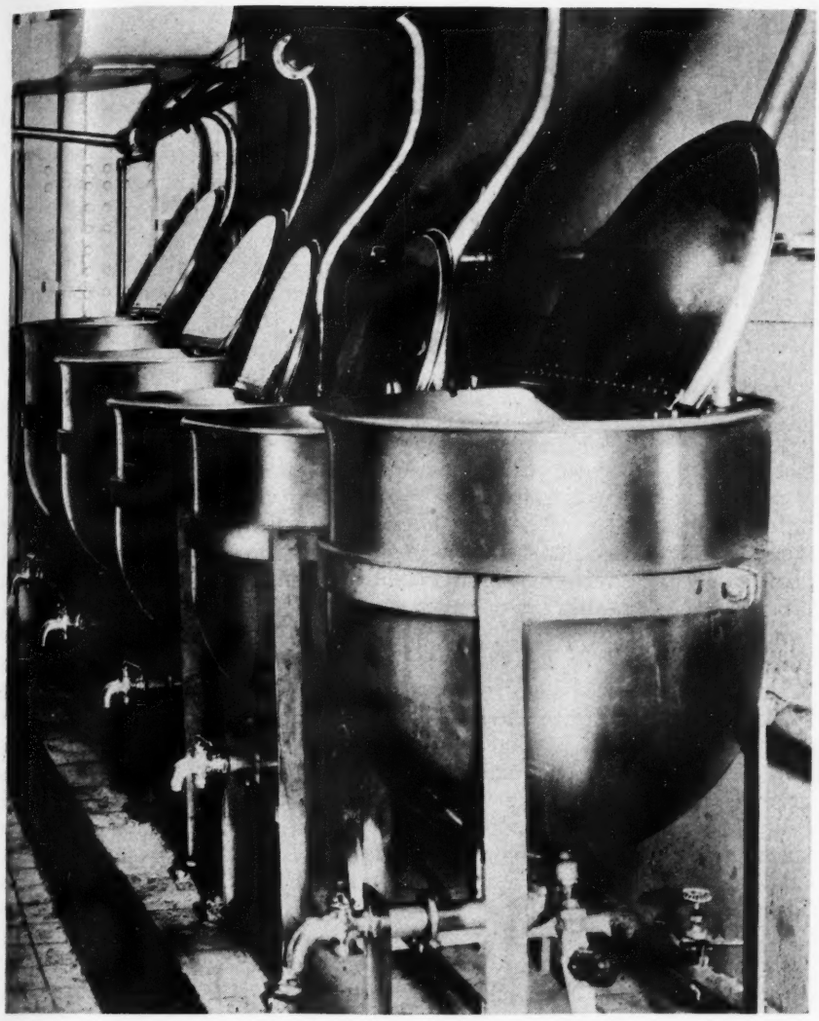
In the mixing of bread and pastry, and in the manufacture of candy and other confectionery, "18-8" is rapidly replacing the metal equipment formerly used. Dough troughs and mixing bowls remain bright and require no refinishing, and the wear resistance of "18-8" makes such equipment virtually everlasting. In bakery "proof ovens," rusting of doors and shelving is eliminated by the use of "18-8" for such parts, and this means freedom from discoloration of bread loaves.

THE introduction of stainless steels, such as "18-8," has widened considerably the choice of materials available for brewery and winery equipment. Stainless "18-8" offers important advantages over the older materials of construction, its outstanding advantages being its immunity to attack and the ease with which its smooth, non-absorbent surface can be cleansed and sterilized. Tests have shown conclusively, and actual installations of equipment in use over periods of years in German breweries have established, the fact that "18-8" is neutral to wort, fermenting beer, and stored beer.

Its use, therefore, for fermenters and storage vats is logical. Even yeast culture, a sensitive operation, can be successfully conducted in tanks made from "18-8." One of these has been in successful use in the United States for two years. That the proper flavor must be secured and maintained in beer goes without question, also there must be no tendency to turbidity or cloudiness. This is insured by the use of "18-8" for storage vats, which may be easily kept clean and sterile.

As beer in certain stages of manufacture may be actively corrosive, the use of stabilized "18-8" (see carbide precipitation below) is advised for all tanks and vats which are fabricated by welding.

In wineries, "18-8" is entirely suitable. Tests have demonstrated that it is not attacked and that the flavor, bouquet, and brilliance are not altered (Searle, LaQue, and Dohrow). The facility with which pumps, bottling machinery, cooling coils, and vats made from "18-8" may be switched from one kind of wine to another is a decided convenience, particularly when changing from red to white wines. All color of wine may be



Cooking kettles of 18-8 stainless steel are immune to attack by food acids, atmosphere, or salt air.

quickly washed from the surface of "18-8."

But a word of caution is advisable. In wines or spirits containing a very high content of tannic acid or tannin compounds, the use of "18-8" for a long period of storage may be inadvisable because of reaction with the iron which may induce discoloration and turbidity. Similar to applications in breweries, the use of a stabilized "18-8" is advisable for all welded equipment.

IT IS in the dairy industry that "18-8" has achieved one of its greatest successes. Numerous tests have been made in the laboratory and dairy as well (Hunziker, Cordes, and Nissen, also Quam and Soloman), and stainless "18-8" has been shown to be an entirely satisfactory metal for the manufacture of all kinds of dairy machinery. This has now been confirmed by over ten years' continuous service in dairies and creameries. Physiological tests have shown "18-8" to be non-toxic, and to have no deleterious effect whatever on vitamine, enzymes, nutritive values, or keeping qualities of milk or any dairy product.

In the dairy plant itself "18-8" is used for storage tanks for milk, cream, and buttermilk. It is used for all types of coolers, using any type of cooling or heating medium, for pasteurizers, weigh tanks, equalizing tanks; while for cheese vats it is unexcelled, as no discoloration or alteration of flavor will result even from long contact.

In truck tanks for transportation from farm to dairy, the use of stainless steel is now well established. Its high strength permits use of light gages, and thus dead-weight is reduced.

The use of stainless steel in the dairy industry reduces up-keep and maintenance cost. There is no necessity for refinishing or polishing. Sterilizers and alkali detergents used for cleaning have no action upon the metal. Even the highly-corrosive calcium chloride brine cooling solutions will not attack if maintained neutral or slightly alkaline. Coolers, cooling vats, storage tanks, pasteurizers, bottling machines, and other types of equipment constructed many years ago still show precisely the same clean brilliant surface as when first installed.

DISCUSSION of chrome-nickel austenitic steels (the "18-8" stainless steels) would not be complete without mention of carbide precipitation. It is directly dependent on the carbon content of the steel and, unless this is maintained low, may result in increased susceptibility to attack and embrittlement in those regions which, through fabrication or otherwise, have been heated in the range 1,000 to 1,500 deg. F., but only when exposed to severely corroding agents.

In ordinary applications of food handling, possible dangers from carbide precipitation are small, and if carbon is maintained low (under 0.08 per cent) will be so small under the usual conditions of fabrication that they can be entirely disregarded.

However, if heavy equipment is fabricated by welding, or if temperatures in the danger zone are maintained for long periods, or if the equipment is to be used for corrosive food products, even such low carbon may become susceptible to attack. For such cases a special "stabilized" composition of "18-8" has been developed. This contains a small percentage of stabilizing element (titanium or columbium) and is given a special heat treatment, which, without altering the characteristic qualities of the metal to a noticeable degree, eliminates the dangers of locally increased susceptibility to corrosive attack.

Machining operations, particularly in automatic screw machines, may be somewhat difficult for the inexperienced because of the distinct work-hardening properties of the metal. For such work a special composition "18-8," generally called "free machining" has been developed and is available in bar forms. This is recommended for such parts as shafting, spindles, and other members of wrapping and bottling machinery, also for screws, bolts, nuts, and studs which must be stainless. Its resistance to corrosion is approximately equal to the regular "18-8," but this composition is not recommended for fabrication by welding.

Nickel and Its Alloys

They are metals that satisfy the exacting requirements of food processing equipment

By F. L. LaQUE
Development and Research Department
International Nickel Co., Inc., New York, N. Y.

NICKEL and nickel alloys are well established by experience as materials that satisfy the exacting requirements of food processing equipment. These requirements are:

1. Availability at a reasonable price in the forms and in the properties required for fabrication, and amenability to fabrication by a variety of methods.
2. Absence of detrimental effects on the product.
3. Durability (resistance to corrosion by products handled, by cleansing and sterilizing compounds, and by heating and cooling media).
4. Ability to transfer heat at a reasonable rate.

Availability and amenability to fabrication are placed first, since it is obvious that, no matter how desirable the other characteristics of a material might be, advantage cannot be taken of them if the material be too expensive—like gold—or if it be available only in a few forms that cannot be fabricated, like the high silicon iron alloys, the corrosion resisting properties of which are very attractive, but the mechanical properties of which seriously limit their application.

Nickel and Monel Metal (a natural copper-nickel alloy) are available in all common forms, such as bars, rods, sheets, plates, tubes, wire, wire cloth and castings. The range of mechanical properties available in sheets, the form in which these materials are most commonly used in the food processing industry are shown in the tables appearing elsewhere in this issue of FOOD INDUSTRIES.

It will be noted that even in their soft condition, both nickel and Monel Metal are stronger than mild steel, and that in their hard state their properties compare favorably with those of heat-treated alloy steels. It is also important that their high strength is not obtained at the sacrifice of the ductility necessary for easy fabrication.

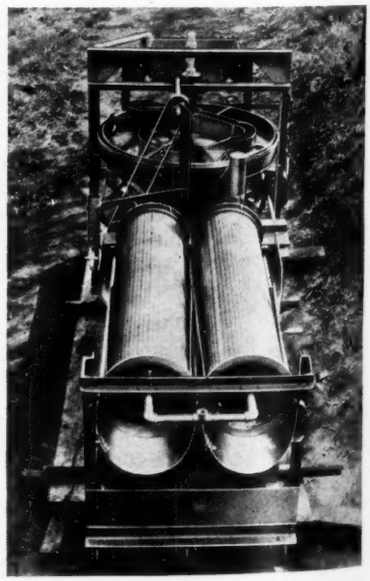
Both metals may be joined by all the common methods, such as riveting, soft-soldering, silver-brazing and welding with gas, metallic arc or carbon arc processes. The heat of welding or brazing is not detrimental to the corrosion resistance of the joints and no heat treatment after welding is required.

Both nickel and Monel Metal can be ground or polished to give whatever finish is desired, an important consideration in many cases from the standpoint of ease of cleaning and sterilization. However, their corrosion resistance is not dependent on a high degree of surface finish and is not, therefore, likely to be affected detrimentally by accidental or unavoidable abrasion or scratching in service.

Nickel as it is used in food processing is non-toxic. This statement is based on the results of several investigations made to determine the safety of using nickel equipment in the preparation of foods. An excellent summary of the situation was made by Drinker, Fairhall, Ray and Drinker ("The Hygienic Significance of Nickel," *The Journal of Industrial Hygiene,* 7, 8, 307-356, 1924) of the Department of Physiology, Harvard School of Public Health, who supplemented a study of the work of other investigators by tests of their own.

It is important also that nickel is not destructive to vitamins. This was shown by the work of Pratt ("Does the Nickel Dissolved From the Container During Pasteurization Catalyze the Destruction of the Vitamins of Milk?" Avery D. Pratt—*The Journal of Nutrition,* 3, 2, pp. 141-156, 1930) at the University of Rochester who used in his studies milk, one of the most perishable of foods, containing on the average about fifteen parts per million of nickel which was compared with milk containing no nickel. His principal conclusion was that nickel dissolved from a nickel vessel did not destroy, or catalyze the destruction of vitamins A, B or C during a pasteurization process.

Several investigations have been made to determine the effects of nickel and other materials on the color, flavor or clarity of different food products (for data on corn, peas and tomatoes, see International Nickel Company Technical Bulletin TS-8). In most of these, nickel contents of greater than 100 parts per million have been studied. In general, it may be stated as a result of these investigations that, of all the common metals, nickel can be tolerated in greatest amount and that the amounts of nickel required to produce a noticeable effect are far above any likely to be encountered in ordinary

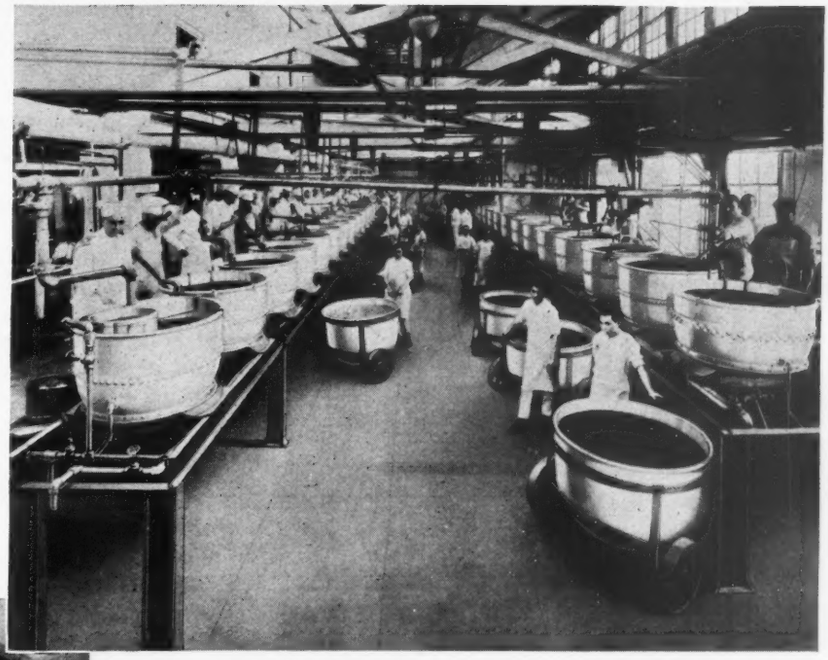


Pea separator with Ni-Resist reel heads and travelers, all other parts in contact with brine being of pure nickel.

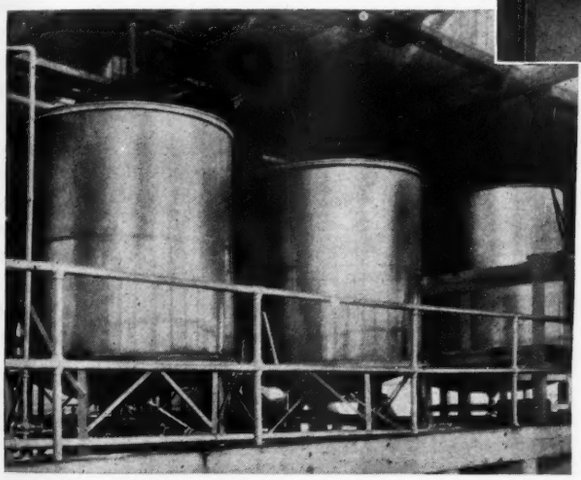
practice. In many cases it was found that no effect of nickel could be noticed at the highest concentration studied, that is, 200 parts per million.

FOOD products are somewhat corrosive, but rarely so in the sense that strong acids are corrosive. Their sensitive properties make them more likely to be damaged by corrosion than to destroy equipment in which they may be processed. At the same time, durability of equipment is to some extent evidence that the product handled is being protected adequately.

Exceptions to the general rule that food products are not destructively corrosive are encountered in the handling of viscous materials containing vinegar or vinegar and salt, such as, for example, mustard which is likely to cause pitting of most metals and alloys. Metals, including nickel and Monel Metal, should be used with caution in contact with mustard.



Pure nickel kettles used for processing soup.



Monel Metal brine-syrup storage tanks installed in vegetable canning plant.

The boiling vinegar-salt solutions used in the manufacture of salad dressing are also appreciably corrosive. The choice of the best material is not clear, since there is no perfect material for the use. Metals such as Monel Metal and nickel may be corroded at appreciable rates as measured by weight loss (0.025 in. penetration per year), whereas the chromium-iron and chromium-nickel-iron alloys which show low weight loss may suffer local attack or pitting. There is some evidence that the alloy Inconel (80 per cent nickel, 13 per cent chromium, 7 per cent iron) will provide a useful resistance, both to general corrosion and pitting by vinegar-salt mixtures. ("The Corrosion of Metals in Mayonnaise Plants," *The Canner,* November 19, 1932, pp. 7-10.) Mixtures of vinegar and sugar are less troublesome and are being handled successfully both by pure nickel and Monel Metal equipment.

The peculiar nature of sweet milk from the corrosion standpoint provides an exception to the general rule that nickel and Monel Metal are adequately durable in food handling service. Tests and practical experience ("Corrosion of Metals by Milk," H. A. Trebler, W. A. Wesley and F. L. LaQue, *Industrial and Engineering Chemistry,* 24, 3, 1932; and "The Resistance of Pure Nickel and Inconel to Corrosion by Milk," International Nickel Company Technical Bulletin TS-1) have shown that nickel is practically completely resistant to corrosion by sweet milk so long as it is being heated up or held at temperature. If the milk happens to be cooling, it may corrode nickel and Monel Metal at appreciable rates. Consequently, neither nickel nor Monel Metal should be used for milk coolers or other equipment handling milk while it is cooling from higher temperatures to about 80 deg. F. For cooling below this temperature, or for heating milk, both nickel and Monel Metal are satisfactory materials. The common preference is for nickel.

The alloy Inconel is completely resistant to corrosion by milk under all conditions and is especially useful where resistance to corrosion by refrigerating brines is also required.

TIN has probably been used to a greater extent than any other metal in contact with foods, principally in the form of coatings on copper for processing equipment, and, of course, on steel in tin cans. It is interesting to note, therefore, that both nickel and Monel Metal are more resistant than tin to corrosion by most food acids. For example, tests in hot tomato juice have shown a ratio of superiority of over two to one for nickel, and over four to one for Monel Metal.

A general idea of the durability of nickel and Monel Metal may be obtained from the fact that we have no record of any nickel or Monel Metal steam-jacketed kettle having required replacement on account of destructive corrosion. Nickel kettles have been in steady use for nearly fifteen years in the preparation of a great variety of soups in the plant of one manufacturer of such products.

Brines, such as are used in the canning of peas and corn, are corrosive to many materials, the corrosion taking the form either of general attack or local attack (pitting). Both nickel

and Monel Metal are highly resistant to both types of corrosion as indicated by results of tests in operating pea brine boiling kettles which showed average rates of corrosion of less than 0.002 in. penetration per year (24 hours per day for 365 days) for both nickel and Monel Metal. Both metals were also found to be free from pitting. These test results are in harmony with and have been confirmed by practical experience.

In addition to the handling of hot brine, nickel and Monel Metal are, of course, useful also for service in contact with cold brines such as in gravity pea separators and the like.

Monel Metal is highly resistant to corrosion by sea water. This accounts for its application to a very considerable extent in the oyster packing industry where equipment must be able to withstand continued exposure to salt water.

Both Monel Metal and nickel are highly resistant to the brines used for refrigeration. Tests in calcium chloride brine tanks in an operating plant where no dichromate or other corrosion inhibitor was used have shown rates of corrosion for both Monel Metal and nickel of less than 0.001 in. penetration per year. Other tests have been made in sodium chloride brine sprays containing no inhibitor. These have shown rates of corrosion of Monel Metal and nickel less than 0.0003 in. penetration per year with no pitting in a 90-day test. This gives these materials an important advantage over other materials which may be adequate from the standpoint of resistance to corrosion by food products, but inferior to Monel Metal and nickel with respect to resistance to corrosion or pitting by refrigerating brines.

Since both nickel and Monel Metal are practically completely resistant to corrosion even by boiling concentrated caustic soda, it is not surprising that they are unaffected by any of the alkaline cleaners used in the food processing industry. For example, tests in 70 per cent caustic soda at 260 deg. F. showed a rate of corrosion of nickel of only 0.000005 in. penetration per year, and of Monel Metal of only 0.0001 in. penetration per year.

Nickel and Monel Metal are resistant to chlorine sterilizing solutions in the concentrations of available chlorine used for the purpose in food processing plants. They, like all other metals used in food processing equipment, are not resistant to, and should not be used in contact with strong chlorine solutions.

A large percentage of food processing operations involves heating or cooling something. Consequently, the materials used to hold the product and separate it from the heating or cooling media should not interfere too much with the transfer of heat. It is, of course, true, but not always recognized, that the resistance to heat flow offered by a metal wall is only one of several resistances which include of greatest importance films of the substance being heated, or of the heating medium which cling to the metal wall. In addition, there may be solid films of corrosion product, scale or baked-on substances which increase the resistance to heat flow. For a more detailed discussion of this subject the reader is referred to an article by Worthington ("Heat Conductivity of Metals as Factor in Heat Transfer," Robert Worthington, *Chemical and Metallurgical Engineering*, August, 1928).

Where the sum of all the resistances to heat flow is high, that of the metal may be of insignificant importance and the choice of metal will not have much effect on the overall rate.

In the food processing industry about the only equipment where the total resistance to heat flow is low enough to make that of the metal itself appreciable are steam-jacketed kettles and certain high velocity heat exchange apparatus, such as multitubular heaters and coolers. With tubular apparatus the gage of the metal tubes is relatively thin so that the maximum difference between the materials of highest conductivity, silver and copper, and those of low conductivity, stainless steel and Inconel, is rarely more than about 10 per cent and often negligible. This is also true of heating coils.

In the case of steam-jacketed kettles the gage of metal is often fairly thick—$\frac{1}{8}$ in. or more—and since the overall rate of heat transfer is high—more than 400 B.t.u. per sq.ft. per deg. F. per hour—the effect of the metal itself may be appreciable. In a particular case it was found that water would be boiled in a copper kettle in six minutes, in a nickel kettle in seven minutes, whereas an Inconel or stainless steel kettle required twelve minutes.

IN addition to pure nickel and Monel Metal, there are in common use in the food processing industry several alloys which may be classified under the general name of white metal. These alloys usually contain from 20 per cent to 35 per cent nickel plus small percentages of zinc, tin and sometimes iron and lead, the balance being copper. While not as resistant as nickel, Monel Metal or the stainless steels to many food acids, nevertheless experience has shown them to be quite adequate for many purposes, especially for the cast parts of dairy equipment, including valves and sanitary fittings, and for can filling and bottling machinery. They can be cast and machined more economically than the more corrosion resistant materials and this property alone accounts for their choice in many instances. Since it is relatively easy to produce sound castings that are free from pores or other defects, smooth surfaces can be secured which facilitate cleaning and sterilization.

During the past few years there has been developed a highly-alloyed cast iron which possesses excellent resistance to corrosion by many chemicals, including food acids and the brines used in the canning industry. This alloy iron which is known as Ni-Resist ("Ni-Resist," a Corrosion and Heat Resistant Nickel-Copper-Chromium Cast Iron," J. S. Vanick and P. D. Merica, Transactions American Society for Steel Treating, 1930) contains either about 14 per cent nickel, 6 per cent copper and 2 per cent chromium; or 20 per cent nickel plus 2 per cent chromium, the latter being called copper-free Ni-Resist.

Ni-Resist will rust, but the rate of rusting is not high and no destructive rusting will occur in the ordinary atmosphere. The principal usefulness of this alloy iron, which is available only in the cast form, is expected to be for structural parts of food processing machinery that may be subjected to corrosion by splash or spillage from corrosive products being handled, or from brines. Copper-free Ni-Resist has already been used to a very considerable extent and entirely successfully on filling machines in the fish canning industry on the Pacific Coast. Its resistance to corrosion by salt water was the principal reason for its selection for this service. This same property accounts for its use with pure nickel in pea separators.

Ni-Resist forms an excellent base for plating with nickel and chromium and with this extra protection has been found to be very successful for a new type of meat chopper.

Copper, Brass, and Bronze

These earliest metals used for food processing equipment still find many important applications

By CARTER S. COLE
Engineer,
Copper and Brass Research Association,
New York, N. Y.

These huge copper brew kettles in the Ruppert brewery, employing more than 200,000 lb. of copper, are a good example of the utility of this metal in the food industries.

COPPER and its alloys, brass and bronze, have many important uses in the preparation of processed foods. Foremost among the industries in which they serve are sugar manufacture, sugar use, fruit and vegetable processing, beverage manufacture, and the dairy industries.

More than twelve billion pounds of sugar are used annually in the United States. In a modern sugar refinery, from the time the raw sugar enters until the finished product is packaged for distribution, every effort is made to keep it in clean, sanitary condition. Copper, brass and bronze are extensively used, as they do not rust and freedom is thus assured from rust discoloration or rust particles in the sugar. These metals also contribute low maintenance expense and long life to the equipment. Centrifuges, process piping, vacuum pans, evaporators, heaters, pumps and strainers are among the sugar equipment constructed of copper or its alloys. In such equipment as vacuum pans, evaporators and heaters, the high thermal conductivity of copper is a decided advantage.

Copper kettles are used for cooking in candy manufacture, as the metal does not tarnish in this service and is unaffected by hot sugar solutions. The working surface remains clean and bright and is easily kept in condition. Some copper candy kettles have been used for 75 years and are still in excellent condition.

Copper has many other uses in the confectionery and chocolate industry. It is used for heating and cooling coils; for lining chocolate kettles; for lining steam-heat bon bon pots; for high temperature vacuum cookers, measuring vessels and thermometers. Brass is employed in candy plants for piping, bearings, cutting arms and other equipment. High heat conductivity, light weight, freedom from corrosion and ease of cleaning recommend these metals to the candy maker.

IN the handling and processing of fruits copper and its alloys is widely used. Fruit juices and syrups, and the saline solutions used in canning have a highly destructive effect upon corrodible materials, and copper, brass and bronze are consequently used in many operations to insure sanitary conditions and efficiency of operation. For example, in the canning of peaches and apricots many items of equipment made from copper or its alloys are used. Automatic pitters and slicers use brass and bronze castings. After lye-peeling, peaches are handled by an elevator having copper flights and side walls. Parts of the blanchers coming into contact with the fruit are made of copper. Copper screens are used in the grader that sorts the various sizes of fruit before they drop into copper chutes that convey them to packing tables and cans. The syrup that is added at this point is handled in equipment having many copper or copper alloy parts.

In canning vegetables brine is often added to the cans, and copper, brass and bronze are useful in equipment for protection against corrosion by this brine, but in the case of certain products like sweet corn, which is subject to discoloration by very minute traces of copper, it is the best practice to tin the copper, brass or bronze surfaces coming into contact with the corn. Tomato juice and canned tomatoes contain a highly corrosive acid and again these metals are used for protection wherever the product comes into contact with the machinery. For example, bronze pump parts are used to handle tomatoes or tomato juice. Equipment for crushing and straining tomatoes is made entirely of brass, bronze and another copper alloy. Chili sauce is also made in equipment constructed of these metals. It is, of course, important that the equipment be thoroughly clean and bright before using

it in contact with foods—a precaution that is important for any material of construction.

Jam and marmalade fruits are often cooked in copper kettles before being put into glass containers.

In the design of copper equipment for dairy products the necessity of sanitation must be considered and the metal used must not injure the flavor. Tin is perhaps the best metal to accomplish this second purpose and consequently tinned copper sheets and tinned tubes are often used. This practice gives the advantages of the high thermal conductivity of copper, its ease of fabrication and cleaning, along with the advantages of a tin surface in contact with the milk. Tinned copper and its alloys are used for certain types of dairy equipment, about 45 per cent of it appearing in the forms of tinned or nickle or chromium plated brass and bronze castings, 25 per cent as tinned sheet, 20 per cent as tinned tubes, and 10 per cent as other alloys.

BREWERIES make considerable use of copper, and have employed it since the earliest days of the industry. High heat conductivity and the fact that it is not corroded by beer, wort or water are the main reasons, but ease of cleaning, ease of fabrication and long-life economy are also important. In this industry copper is used for brew kettles, mash tubs, coolers, filters, grants, pipelines, parts of bottling and racking equipment and other metal parts that come into contact with the product.

One precaution should be kept in mind concerning the use of metallic copper. It is slightly soluble in some foods and, as in the case of milk, must be tinned or otherwise coated to protect food flavors. With many other foods this is not the case, and the copper gives good results in direct contact. Where air or oxygen can be excluded, copper is practically insoluble and free from attack by any ordinary food ingredient. Copper alloys to withstand any usual form of attack met in the food industries are readily available.

BRIEFLY, the properties and characteristics of copper of most interest to factory operators are its ease of fabrication into any form or shape; its high thermal conductivity (0.94 c.g.s. units at 20 deg. C.); its good tensile strength, and the readiness with which it may be coated, plated or alloyed with other metals.

Copper Alloys
In Food Manufacture

Greater strength is imparted by alloying copper, and with some alloys, greater resistance to corrosion.

By JAMES T. KEMP
Service Engineer, The American Brass Co., Waterbury, Conn.

CERTAIN food industries, which have used copper for their equipment for many years, are using this metal in even larger poundages than ever before. The conspicuous examples are the breweries, distilleries, yeast plants, sugar refineries, bottling plants and the like. Very little metal other than copper is to be found in such plants in contact with the raw, cooked, or finished products. A small yeast plant recently built in the West required upwards of 200,000 lb. of copper in sheet and tubular form for the cookers, piping, filters, tanks and other equipment. The poundage required by breweries runs into similarly large figures.

The evolution of a satisfactory bronze welding rod for arc welding copper has simplified and cut the cost of constructing welded equipment. Carbon arc welding has gone some distance in the last two years in replacing the older practice of brazing. One of the larger distilleries recently erected in southern Illinois was almost completely assembled by electric welding.

Among the alloys essentially made of copper and used in food plants should be mentioned the 85 per cent copper, 15 per cent zinc, Red Brass pipe. This is used for hot and cold water lines, steam pipe, and lines conveying certain liquid products under pressure. This high-copper type of brass has practically the same chemical resistance to corrosion as copper metal, but with improved strength and stiffness. Admiralty metal in the form of thin-walled, seamless tube is commonly used in heat exchanger units and for heaters, such as those used in packing plants. Admiralty is also the most widely used tube metal for heat exchangers and condensers in power generation.

The copper-silicon alloys of the type popularly known as Everdur have been used increasingly in recent years because of their high strength. They are readily welded by both gas and electric means and are well suited to the manufacture of vessels subjected to mechanical loading. The greatest poundage of these alloys has, however, gone into hot water storage tanks for food and other industries as well as general hot water service where a non-corrodible tank is required to contain water under pressure.

Tobin Bronze in rod form is used for pump shafts, stirrer and paddle shafts inside of mixing tanks and processing vessels, for bolts, nuts, and similar parts.

The nickel silvers, Ambrac, the low zinc variety of copper-nickel-zinc alloy, and more recently the cupronickels, are used where white metals with their improved resistance to chemical attack and high physical strengths are required. Often the greatest value of these white metals has been in their appearance. Nickel silver is the usual base for silver-plated utensils. The 30 per cent cupro-nickel, Supernickel, is used for thin-walled heat exchanger tubes in places where copper or Admiralty are not sufficiently resistant to attack.

Seamless copper tube for water and and stock lines has become popular in food and many similar industrial plants. The smooth interiors, which solder fittings permit, reduce the frictional head losses and prevent the accumulation of solid or fibrous matter within the lines. The ductility of these tubes permits them to be erected with almost the facility of electrical cable. Tubes for ordinary use and low or medium temperatures are joined with a solder composed of tin and antimony. Silver solder is preferred for temperatures above boiling water and for high pressure lines.

Tin

As an Anti-Corrosion Coating

By BRUCE W. GONSER

Metallurgist,
Battelle Memorial Institute,
Columbus, Ohio.

Spraying a copper milk cooler with a tin coating, a satisfactory method of tinning large or fixed pieces of equipment.

OUTSTANDING among the physical properties of tin[1] are a relatively low melting point, low hardness (little more than that of pure lead) and a bright silvery luster. These in terms of food equipment mean that its use is limited to temperatures below 450 deg. F.; that tinned surfaces should be handled with reasonable care to prevent scratching; and that a shining sanitary appearance is presented by tinned equipment that is kept clean.

The heat conductivity of tin is fair—of tinned copper, excellent. The heat emissivity of clean tin is exceptionally low, only about 4 per cent of that of a black body. This means that a tinned surface makes an excellent insulator from radiant heat.

From the standpoint of corrosion, tin is very resistant to the atmosphere and to neutral or nearly neutral solutions, such as water, carbonated water and milk. It is seriously attacked by inorganic acids and fairly strong alkalis. Most organic acids like tartaric, citric, lactic, oxalic and malic acids attack tin to a slight extent, especially in the presence of oxygen in air or oxidizing agents, but this corroding action may be almost eliminated by excluding oxygen. Acetic acid attacks tin very slightly, even in hot, fairly concentrated solutions, and scarcely at all in cold dilute solutions.

When tin merely forms a protective covering over steel or copper, corrosion is not just a question of attack on tin, but also on the underlying metal which may be exposed by mechanical injury or through very small holes in the coating due to imperfect tinning.

IN PREPARING foods for canning, well-tinned equipment is very suitable where the lining is not subject to severe abrasion and where fairly strong acids and alkalis are absent. Corrosion tests in a pea processing plant, for example, showed tin to be excellent in contact with all products and in all the solutions up to a 10-per cent salt brine.[2] In a hot salt-sugar brine, slight corrosion took place, but less than in the case of nickel-silver, copper, bronze, brass or zinc. For corn processing equipment, tin was very satisfactory, and was not seriously attacked even in a hot sugar-brine solution.[3] Some fruit and vegetable acids do attack tin in open containers, depending on the conditions present. Of these, malic (from apples) and citric are most active. Spinach, rhubarb, squash, pumpkin, grapefruit, berries, cider and apples are the principal foods that appreciably attack tinplate, although not to such an extent that objectionable amounts of tin contaminate the product.

Block-tin pipe has long been regarded as ideal for transporting distilled water; it is equally desirable for handling carbonated beverages. Beer can be handled satisfactorily in tin if the beer is neutral; turbidity may result if it is not. Mildly alkaline mineral water is always bottled with tin-foil inserts in the caps. Lquids containing any tannic acid become darkened if handled in ordinary tin plate because of the action on exposed iron. Hydrogen sulphide and organic sulphur compounds also darken tin or tin plate.

The lightness, inexpensiveness, sanitary appearance and ease of rendering the surface smooth and nonadhering are factors very favorable to tin plate for handling baked goods, candies and the like. In this service, there are no corrosive conditions to combat and with care in using proper cleansers, tinned equipment has a very satisfactory life for this work. The same is true for equipment handling cereals and similar dry foods. In handling meat products, heavily tinned equipment is used to give a reasonable life without a heavy capital expense. Tin is not the best metal to use in strong, hot salt brine, however.

MOST food specialties, such as those involving the use of vegetable oil, may be handled safely and economically in tinned equipment. Salad dressing using vinegar is not an exception.

In the dairy industry, tinned equipment has been widely and successfully used for many years. There is no general attack on tin by sweet milk under any conditions. Local corrosion may sometimes be encountered in open containers, especially where base metal is exposed, due to electrochemical action where dairy products are kept a comparatively long time.[4] Some corrosion may occur when lactic acid is formed when milk sours. For intermittent use, transportation of milk, and handling products like ice cream, tin is excellent. Tin has been shown to be perfectly satisfactory for milk evaporators and for all manufacturing equipment, storage tanks, and so forth, used in making condensed milk.[5]

Usually, more damage is done to tinned surfaces by unsuitable cleansers than by wear and tear in practical use. Strong alkali cleaners and acids are too corrosive. Soap and water is often sufficient, but for a more effective detergent, trisodium phosphate is excellent and not injurious. A hot dilute solution of sodium carbonate or of sodium hydroxide, as a ½ per cent solution, makes a very effective cleanser if a reducing agent is added.[6]

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Lead

Never used in contact with food, is important in building construction and maintenance.

By F. E. WORMSER
Lead Industries Association, New York, N. Y.

HIGHLY useful lead products of widely varying description are at the disposal of the designer of industrial establishments and the factory manager. Probably the two classes of lead products of greatest interest in this connection are: (1) lead pigments, particularly white lead and red lead, and (2) lead pipe and sheet.

The lead pigments are notable for their outstanding high durability and economy. White lead and red lead make paints that are standard throughout the world for timber and steel construction, respectively. There is one aspect of the use of white lead as paint, *i.e.,* its economy, which should be emphasized, especially as the industrial engineer is so largely concerned with questions of comparative costs. White lead is sold by the pound in a concentrated, or paste form and has to be diluted with linseed oil and stirred to paint consistency before application. White lead has a strong affinity for linseed oil, the commonest vehicle for paint mixtures, and it may be used with other vehicles to form various types of paint, including interior flat paints of great body, adhesion and durability, and unexcelled washability. White lead is also a constituent of the highest grade prepared paints. In using white lead paints in the interiors of food plants, the only precaution to observe is to protect the paint from exposure to the sulphur sometimes contained in fuel gas. This gas will darken the paint, but the trouble can be overcome by using a special fume-resisting paint over the white lead.

Red lead is made by oxidizing metallic lead, first to litharge, a monoxide of lead, and then oxidizing the litharge to red lead. Improvements have been made in the quality of red lead produced nowadays, which preserve its liquidity in paint form. The modern commercial red lead contains over 95 per cent true red lead, the balance being mainly litharge, whereas formerly only 85 per cent of the product was composed of red lead. The litharge content had a tendency to cause a setting of red lead in the paint can.

Incidentally, litharge, mixed with glycerin, makes an excellent cement and has many useful applications. It is often used for packing joints in pipe lines and for service where corrosion is a factor, such as setting acid resisting brick.

Lead chromate pigments are also used in protecting iron and steel from corrosion. They are bright yellow, orange or green in color, but possess the disadvantage of being higher in cost than red lead and are, therefore, generally only used where the distinct shades of the chromate are in demand. Blue basic sulphate of lead is another lead pigment used in industrial plants for iron and steel surfaces.

Lead sheets lend themselves to many uses in the factory structure, such as flashing, roofing, gutters, chimney flanges. Owing to the unusually high corrosion resistance of lead, sheet lead flashing is particularly desirable where there are sulphur or ammonia fumes to withstand. Sheet lead flashing will be found specified by many manufacturers of composition material for factory construction. Moreover, lead is so easy to work that it can be readily fashioned into numerous special articles or equipment. If salt water for non-food purposes or sulphuric acid are handled in a plant, lead will be found an excellent material for conveying and holding these chemicals.

Sheet lead is available as soft lead, antimonial lead and tellurium lead. Antimonial lead, containing about 6 per cent antimony, has about twice the tensile strength of soft lead and may, therefore, be used in thinner sheets. In addition to being stronger than soft lead, tellurium lead, containing about 0.03 per cent tellurium, possesses an unusually high resistance to corrosion by sulphuric acid and is an alloy of recent introduction in the United States.

Lead pipe may be obtained in all sizes and wall thicknesses and also in alloy form, particularly as antimonial lead or tellurium lead. In addition, a tin-lined soft lead and antimonial lead is available in the United States and is used where corrosive natural waters make the use of other metals impracticable or costly. Owing to the ease with which lead pipe may be welded, burned, or soldered, it, too, lends itself to the construction of cooling or heating coils and other apparatus. It may even be extruded in odd shades, *i.e.,* with fins to make radiation faster. Lead pipe should not be used in contact with ingredient or potable waters.

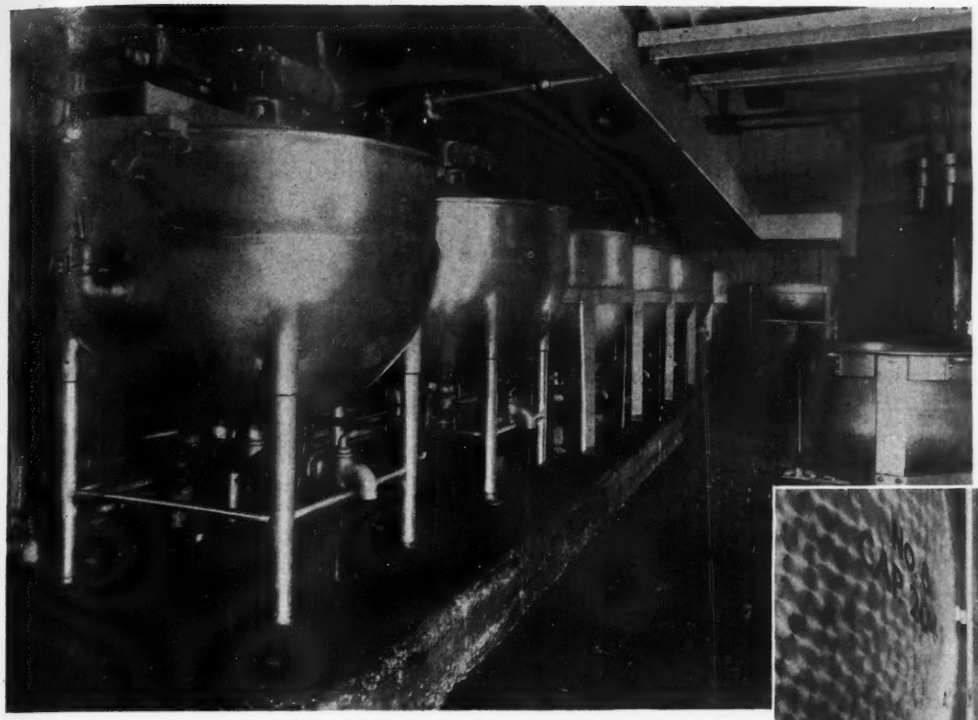
Regardless of where lead is used, however, there is a simple precaution which should be observed, namely, that it be protected from corrosion by free lime wherever it comes into contact with unseasoned cement or concrete. Protection can generally be provided through the use of an asphalt paint or tar paper over the lead.

THERE are numerous lead products which are highly important factory materials, particularly soft solder of the ordinary tin-lead type, which is used not only in soldering cans but in electrical work, etc., and lead-bearing metals which are known as babbitts and have been used for a great many years in moving machinery. Tinsmiths work with solders containing 40 to 50 per cent tin, the balance lead. Wiping solder usually contains 37 to 42 per cent tin and the remainder lead, and is handled in the plastic state to make an unexcelled bond between two lengths of pipe.

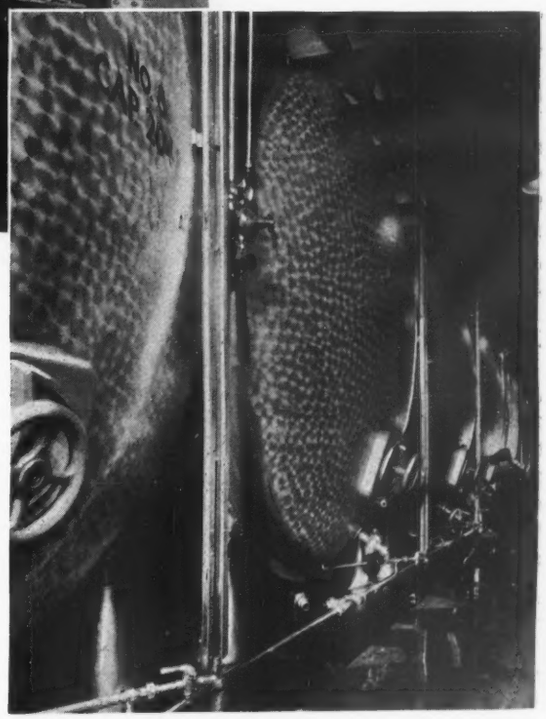
Lead is an admirable metal to use where vibration of all sorts must be resisted. If a factory building rests alongside railroad or subway construction, where passing trains might cause the building to vibrate, one means of overcoming this condition is to use lead-asbestos, anti-vibration mattresses. As their name indicates, these pads consist of two layers of heavy sheet lead enclosing two layers of asbestos board, the entire pad being about ½ to 1 in. thick. At the same time lead pads, smaller in size, are used under moving machinery.

Wherever an industrial establishment makes use of X-ray apparatus, either industrially or hygienically, lead gives the best protection against the harmful effects of the rays.

Some miscellaneous uses of lead comprise the familiar anchor bolt; the use of lead-headed nails in applying metal roofing material and siding; and the use of lead safety treads, which are cheap and easily renewed.



Left: Aluminum steam jacketed kettles in the Chicago plant of College Inn Products Co.



Below: Aluminum horizontal government storage tanks, each of 204 bbl. capacity, in use at Victor Brewing Co., Jeannette, Pa.

Aluminum

Possesses wide adaptability to the many conditions and requirements of the food industries

By J. R. AKERS
Aluminum Research Laboratories
New Kensington, Pa.

USE of aluminum in the food industries began in a small way and in the smallest unit of the industry, the home kitchen. From there its use has steadily increased until now millions of pounds of the metal are made each year into units for the preparation, storage, distribution, and serving of food.

Aluminum equipment for food preparation and handling is standard in a large number of the world's finest hotels, hospitals and ships; is specified as standard mess equipment for the armies and navies of many nations; and is made special for the industrial manufacture, storage, and transportation of foods and beverages. It is in common use in bakeries, canneries, packing plants, dairies, creameries, and breweries. Batteries of aluminum cookers are used in the preparation of breakfast foods. Special aluminum mixers and cookers are employed in the manufacture of candies. As a matter of fact, there are very few food products or wholesome beverages that are not handled in aluminum during at least a part of their preparation.

The attention of many public health and nutrition investigators has been focussed critically upon aluminum for many years. These investigators have determined the solubility of aluminum in food materials, in acids, and in various beverages. They have studied the effect of both the elemental metal and its compounds upon foods, vitamins, animals, and human beings. Accounts of the work of these investigators contain evidence that aluminum is non-toxic and that when foods are cooked, processed, stored, or shipped in aluminum that the metal has no adverse effect upon their wholesomeness, healthfulness, flavor, or appearance. Aluminum and aluminum salts have been proven non-toxic and without psysiological effect unless administered in amounts from 50 to 100 times the quantity that could possibly be taken into any food by being cooked in aluminum.

HOWEVER, general application of a metal in modern food industry depends on much more than the mere fact that it is resistant to corrosion and safe for use in contact with foods. It must be adaptable to fabrication into a variety of shapes;

must have rigidity and strength to withstand severe service; must stand pressure at high temperatures; and should be light in weight, resistant to corrosion, reasonable in price, and easily maintained.

Aluminum is light and strong; highly resistant to the chemical action of many foods; and its cost is reasonable. The metal is available in the form of bars, castings, pipe, rod, wire, sheet, foil for packaging and for thermal insulation, and aluminum bronze powder for the pigment portion of paint. It may be rolled, drawn, extruded, hammered, riveted, soldered and welded. It is easily cleaned and aluminum equipment will give long years of satisfactory service if kept clean and dry when not in use.

The cleaning and care of aluminum is a subject which deserves attention. Maintenance of clean surfaces on aluminum is not difficult. Intelligent use of a mild abrasive, a safe cleanser, and plenty of water is all that is required. Aluminum is attacked by alkaline salts and by chlorine. Hence strongly alkaline cleaners and sterilizers should not be used. Harmful cleansers and certain chlorine sterilizers not only discolor, but their action is sometimes so corrosive that the useful life of the equipment is greatly shortened. Safe cleansers and sterilizers for aluminum may be obtained from reliable manufacturers and retailers.

EACH branch of the food industry has its own cleaning problems, but whatever the problem there are usually a number of materials that will do the job safely. It should be remembered that the appearance of any metal is more easily maintained than restored; and for this reason, it behooves the user to see that the condition and appearance of his equipment is maintained at all times.

Because of its adaptability to unusual conditions and requirements a great deal of aluminum equipment is in use as milking machines, buckets, strainers, various types of weighing, mixing and holding tanks, tank trucks and cars, freezers, pasteurizers and sterilizers, pipe and coils for heating, cooling, and circulating.

Many reliable investigators have definitely established that aluminum does not affect the quality or flavor of milk or milk products; that the solubility of aluminum in milk, in cream, and in buttermilk has been found to be very low—ranges from a fraction of a part to only a few parts per million; and that many times these quantities of aluminum have been fed to animals and taken internally by human experimenters over considerable periods of time without harmful results.

An advantage gained by the use of aluminum equipment in the dairy industry is the ease with which it can be kept clean and attractive; safe and efficient dairy cleansers are available.

Aluminum tanks, coils, and tubing used for cooling equipment require special protective attention. Many cooling systems circulate sodium chloride or calcium brine as the cooling medium. Ordinarily these brines are corrosive to aluminum, but their corrosive action can be prevented by the simple expedient of adding either potassium dichromate or sodium dichromate to the salt solution. The addition of this inhibitor at the rate of 1.0 per cent of the chlorine content of the dissolved salt will be effective.

Aluminum ham boilers, meat loaf pans, vats, steam-jacketed kettles, cookers, pans, aluminum-lined refrigerators and chill rooms are all a part of the standard equipment of the packing plants. Here, too, lightweight trucks and buggies of various kinds are an economical asset.

Aluminum steam-jacketed kettles are widely used in the canning and preserving industries. Practically every kind of fruit and vegetable that is canned or preserved is handled by some producer in aluminum equipment, and a number of these products have been put up in aluminum cans.

THERE are many uses for aluminum equipment in making bakery and confectionery products. Mixing boards, bread pans, pie and cake pans, utensils for the preparation of pie fillings, mixers of various types and many other auxiliary utensils are used as also are kettles for sugar boiling and for the heating of syrups, toffies, and fondants. Aluminum is suitable for molds and dipping trays, crystallizing pans, and various types of cookers.

Aluminum finds numerous applications in the citrus fruit industry in the form of washing vats, conveyors, sorting and cutting tables, presses, storage vats, cookers, tubing, pans, and trays. All have proved satisfactory for the preparation of citrus juices, preserves, marmalades, syrups, and related products. Because aluminum is very resistant to the action of the juices of these acid fruits it has a definite place in citrus fruit plants. In one set of experiments made at room temperature, it was determined that an aluminum alloy recommended for handling citrus juices was uniformly etched at the low rate of 0.00017 in penetration per year in lemon juice, 0.00020 in. per year in orange juice, and 0.00024 in. per year in grapefruit juice. At elevated temperatures, the rate of attack was somewhat higher. An added advantage in using aluminum utensils for processing such acid materials is because the minute amounts of salts that may be derived from the equipment are not only harmless, but they are colorless and therefore do not discolor materials cooked therein.

Although aluminum brewing equipment has been successfully used in European countries for many years, it is only since the repeal of prohibition that it has become standard in many American breweries. Aluminum and aluminum alloys are suitable materials for the manufacture of the equipment used in handling and processing malt liquors. Brew kettles, filters, steam coils, yeast tubs and vats, buckets, fermenting tanks, storage tanks, pasteurizing equipment, and pieces of auxiliary equipment made of commercially pure aluminum, or a suitable aluminum alloy, are in use in many American breweries today. Thousands of aluminum beer barrels are now being used. Aluminum coils, for which there are readily available a number of safe and efficient cleansers, are widely used for dispensing beer because this metal has no effect on the taste, color, or clarity of the beer.

ANY account of the utility and applications for aluminum in the food industry would be incomplete if the advantages of aluminum paint were not mentioned. Cleanliness and good lighting is desirable in all industrial establishments and this is particularly true for factories in which products are prepared for human consumption. A good aluminum paint reflects about 70 per cent of the light that falls upon it, is easy to clean, and is highly impervious to moisture giving adequate protection to wood and other materials of construction from the moist conditions that often exist in industrial kitchens and factories.

Properties and characteristics of aluminum and some of its important alloys appear in the tables elsewhere in this issue of FOOD INDUSTRIES.

Concrete
for Structures and Equipment

By A. J. BOASE
Manager, Structural and Technical Bureau, Portland Cement Association, Chicago, Ill.

GOOD manufacturers find in concrete a low-cost material with many applications both in buildings and in equipment. It is one material whose composition can be varied to suit different conditions, and it may be surface-treated with various coatings to make it durable under exposure to several otherwise destructive agents.

Composed of portland cement, water and aggregates, concrete has a compressive strength ordinarily between 2,000 and 4,000 lb. per sq.in., and it can be made to withstand a compression load of as high as 10,000 lb. per sq.in. The strength can be varied to meet particular conditions, the principal factor being the water-cement ratio used in the mixture. The tensile strength of concrete is relatively low, ordinarily being about 200 to 400 lb. per sq.in. Ordinary concrete withstands abrasion well, and for very severe conditions special aggregates can be used.

The low temperatures employed in many food plants have no effect on this material if it is of high quality, although alternate freezing and thawing will damage wet concrete if it is weak. As to thermal conductivity, the material varies widely, but a typical sample will conduct about 8 B.t.u. per hour per sq.ft. per in. of thickness per degree F. difference in temperature.

One of the best fireproofing materials in building construction, concrete is subjected to temperatures in excess of 2,200 deg. F. in standard fire tests. But where it is exposed to heat continuously, it is advisable to keep the temperature below 500 deg. for load-bearing material and under 900 deg. for other concretes. The coefficient of thermal expansion of the material is low, varying between 0.0000038 and 0.0000066, with 0.0000055 being the most commonly used value.

ASSUMING that concrete will meet the physical specifications for a certain structure or piece of equipment, the food manufacturer then must consider, as he does with other materials, whether it will deteriorate under exposure to the particular food or chemical with which it is to be used. In considering this, the concrete must be assumed to be of suitable quality. In general, this means a well-cured, dense, watertight material.

Concrete may be surface-treated for almost any degree of protection. The more common treatments include: (1) magnesium fluosilicate or zinc fluosilicate; (2) sodium silicate; (3) linseed oil; (4) cumar; (5) varnishes; (6) bituminous or coal-tar paints, tar and pitches; (7) bituminous enamel; (8) bituminous mastic; (9) vitrified brick or tile; (10) glass; (11) lead; (12) rubber.

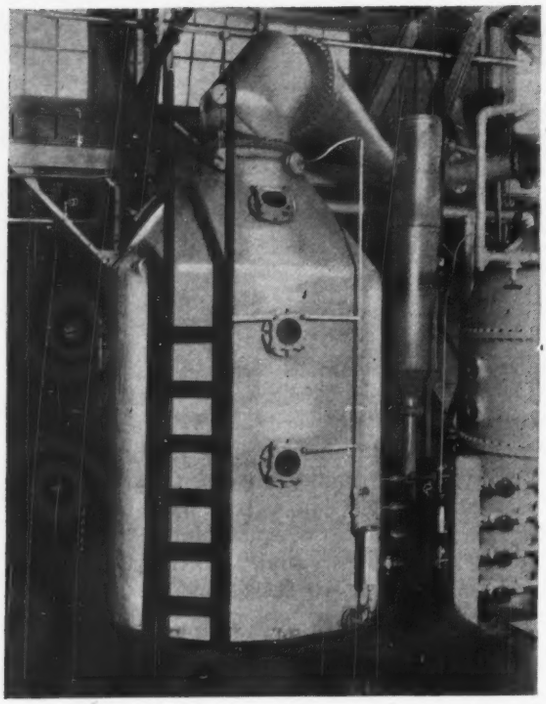
Many foodstuffs and chemicals occurring in foods or used in plant operations have no disintegrating effect on concrete, and others, while they produce slow disintegration, cause no damage if the concrete is treated with the proper surface coating. Among the substances having no effect on well-made concrete are calcium chloride, sodium chloride, cottonseed oil, menhaden oil, alcohol, baking soda in weak solutions or dry, beer, brine, fruit juices, honey, molasses, sugar, and wine.

In the case of cottonseed oil, there is a slight disintegration if exposed to air, and a surface treatment (1 or 2) should be used. While beer causes no progressive disintegration of concrete, a special coating (a widely-used one is made and applied by Turner-Rostock Co., New York) is used in storage and fermenting tanks to guard against contamination. Milk has no effect on concrete if sweet, but the lactic acid in the sour product causes a slow disintegration. It is advisable to treat (1, 2, 3, 4, 5) all concrete coming in contact with milk products because any milk absorbed will sour and form lactic acid. Dark, partly refined molasses may attack the material if it is not dense and thoroughly cured, and a surface coating (2, 5) will be advisable under such conditions. While sauerkraut has little if any effect on concrete, a surface coating (1, 2) should be used to protect the taste. Similarly, wines have no effect but their taste may be affected. To overcome this the concrete may be treated with two or three applications of tartaric acid solution or sodium silicate. Some wineries, producing fine wines, line concrete tanks with glass tile.

Here are the substances which have a slowly disintegrating effect on concrete but with which the material may be used if it is protected with a surface coating. Acetic acid (use surface treatment 5, 6 or 7); almond, coconut, olive, poppy-seed, walnut, peanut and soy-bean oils (1 or 2); lard, tallow (1, 2); most fish oils (1, 2); sal soda and saltpeter (1, 3, 4, 5, 6 or 7); carbonated water, caustic soda, cider, corn syrup, glucose, and vinegar (for the last six substances use treatments 1, 2, 3, 4, 5, 6 or 7).

Many solutions which have no chemical effect on concrete, such as brines and salts, may crystallize upon loss of water. If the concrete is porous enough to absorb these solutions, crystallization may take place inside the material and exert a pressure which may be sufficient to break it down. In structures or equipment subjected to frequent wetting and drying by these solutions, it may be advisable to provide some surface coating, such as sodium silicate, linseed oil or one of the varnishes as added precaution.

CONCRETE is satisfactory and economical for many uses connected with the food industry. Reinforced concrete is one of the most widely used materials for building frames—columns, beams and girders—and for floors. The walls may be of reinforced concrete or precast concrete units. Concrete will also prove advantageous for silos, tanks, vats and working surfaces such as tables and benches. When properly used, concrete is very durable and requires little maintenance.



Concentration of lemon juice in the Ontario, Calif., plant of Exchange Lemon Products Co. is carried out in a glass-lined vacuum pan.

Glass-Lined Equipment

Linings must be supported on a suitable backing, and any discussion of glass-lining must include a parallel discussion of the supporting equipment and the adaptability of the combination to the service required

By P. S. BARNES
Chemical Division, The Pfaudler Co., Rochester, N. Y.

MANUFACTURERS of food products must give particularly careful thought to the materials from which the equipment they use is constructed so that their product, in passing from the raw to the finished stage, will remain unimpaired. From this standpoint the ideal material of construction is one which is inert toward the foods with which it comes in contact and which lends itself to complete sterilization.

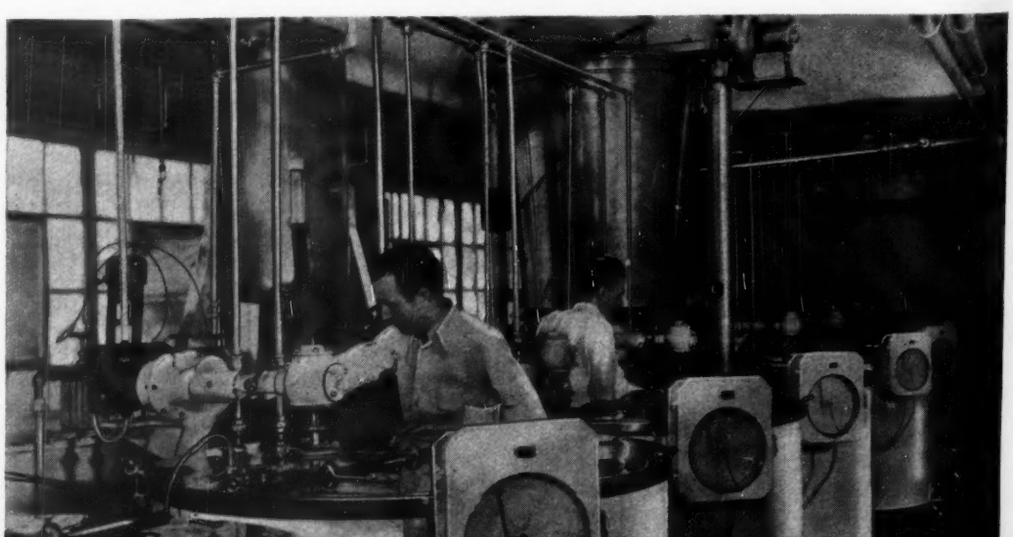
Considerations which favor extensive use of glass-lined steel process equipment in the food industries are:

1. Protection of the product against the introduction of impurities in the form of dissolved metals and against the consequent effect on color and taste. Glass enamel is entirely insoluble in any and all food products because of their neutral or acid reaction.

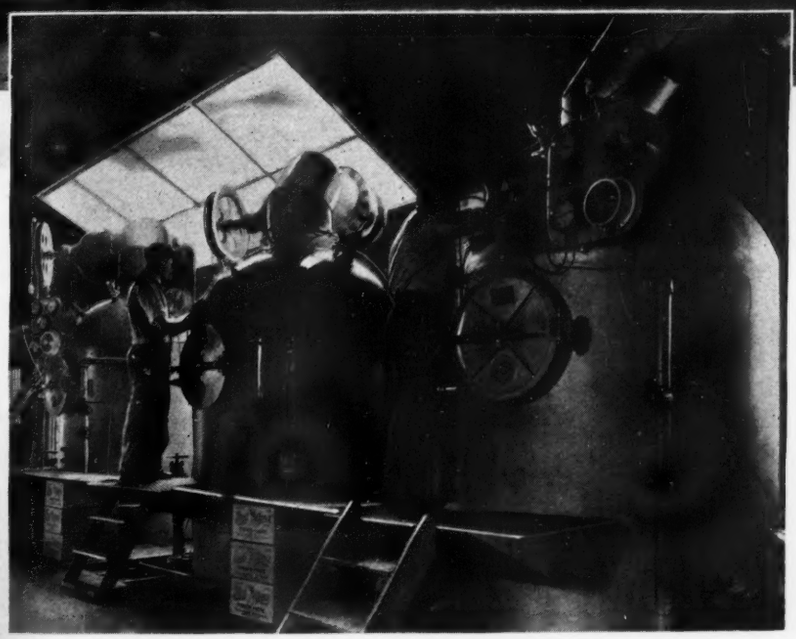
2. Protection of the equipment itself against corrosion from organic acids; none of which exerts solvent action on glass enamel.

3. Opportunity for complete sterilization because a smooth and non-absorptive surface permits easy and thorough cleaning. Examination under the microscope shows a vitrified surface to be ideal in this respect; it affords no lodgement for bacteria.

The terms "glass-lined" and "glass-enamel-lined" are synonymous and refer to complex boro-silicates fused to steel at a high temperature and pre-



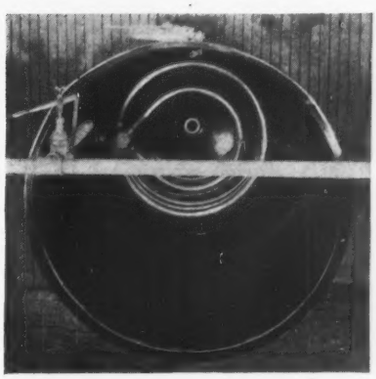
Installation in the Valley Bell Dairy Co., Charleston, W. Va., plant is typical of glass-lined batch pasteurizers.



Above: Several types of glass-lined mixing and storage tanks are used by National Nugrape Co., Atlanta, Ga., for the preparation of flavoring syrups used in its carbonated beverages.

Left: Manufacture of tomato puree by Helen Packing Corp., North Collins, N. Y., involves concentrating tomato pulp 25 to 35 per cent total solids in glass-lined vacuum pans.

Below: Looking down into an open glass-lined cooker with a single heater coil for concentrating tomato pulp to puree.



senting a non-porous, highly acid-resistant surface. Because of their silicate base, they must be exposed to alkaline solutions with caution. As a rule this precaution in the food industries applies only to cleansers.

Because the coefficient of expansion of the glass enamel approximates that of the steel shell, moderately rapid temperature changes are in no way injurious. As a result, glass-lined equipment is available in steam or brine-jacketed types as milk pasteurizers, vacuum pans for jams, jellies and preserves and storage tanks for milk and ice cream mixes.

BY FAR the largest use for glass-enameled steel in the food industries is in the processing, storage, and transportation of milk products, where sanitation, purity, and taste protection are major considerations.

Milk pasteurizers of both the batch and continuous automatic type represent the largest individual use. The batch type is cylindrical in shape and jacketed for low pressure steam for heating and holding. Accessories such as the agitators and thermometers are introduced vertically downward through the insulated covers and are removable for sterilization.

Development of the glass-lined storage tank has made possible the storage and transportation of milk in bulk units of several thousand gallons. Plant storage tanks are customarily built in sizes ranging from 3,000 gal. upward.

Hundreds of glass-lined steel tank cars, having capacities of 6,000 and 8,000 gal. each, are now in daily service bringing milk over long hauls to most of our principal cities. Two 3,000 or 4,000-gal. insulated tanks are built into each insulated car.

Other uses for glass-lined equipment in the dairy industry are in the

pasteurizing of cream, storage of condensed and evaporated milk, pasteurizing and ageing of ice cream mixes, manufacture of buttermilk, and vacuum deodorizing of cream for butter.

DATING back over 50 years, the brewing industry has made very large use of glass-lined equipment for storage and fermentation. A vitrified surface meets the requirements of this industry because malt beverages are particularly susceptible to spoilage from bacterial contamination and to turbidity or impairment of flavor from contact with some metals. Beer storage tanks and fermenters in individual capacities of 60,000 gal. are by no means uncommon.

Glucose, vinegar, and cottonseed, olive, coconut, and similar edible oils are also held in large storage tanks.

Because of their high acidity, tomato products are processed to advantage in glass for concentration, either under vacuum or in open cookers, to a puree or paste form, and for holding tanks.

Branches of the food industries which process various fruits are also large users of glass-lined equipment; particularly in the form of vacuum pans for jams, jellies, preserves, and fruit concentrates of all kinds.

Glass-lined vacuum pans, along with open-jacketed kettles for making up the initial dilute extract, also find use in the handling of vegetable concentrates such as prepared baby soups.

Among the acid-containing foods are mayonnaise and salad dressings which are also handled to advantage in glass-lined machines where the highly corrosive effects of vinegar are nullified.

APART from their staple products, food manufacturers are showing an increasing tendency to develop side lines and specialties; often for the utilization of by-products. Frequently, these processes involve strongly acid conditions where glass-enameled equipment is desirable. For example, two large corn products concerns have gone into the manufacture of lactic acid by fermentation; a milk company is making the same acid from waste whey. Meat packing houses are utilizing their offal to an increasing extent in the manufacture of pepsin and special biological products from animal glands.

Glass-lined percolators, operating on the pressure-vacuum principle by positive circulation, are used in the manufacture of various extracts, particularly vanilla. Edible gelatin solutions in course of refinement are handled in glass enamel to particular advantage because of their mineral acid content, thus eliminating dissolved metals as an impurity in the final product.

The constituents of coffee extract are notably sensitive to contact with most metals, possibly due to catalytic effect on the essential oils which determine the flavor; hence, the use of glass-lined equipment is recommended for its preparation and concentration.

Sugar syrups are made up and pasteurized in glass so that after-sterilization of the equipment may be positive. When acids are added for inversion or as ingredients in beverage syrups, the lining affords protection against acid action.

Glass Piping Promotes Cleanliness

By W. A. KATES

Industrial Division, Corning Glass Works, Corning, N. Y.

ALL food processing operations have the common cardinal requirement of cleanliness. The product may vary in character yet cleanliness is primary and a common factor contributing to customer satisfaction. Its maintenance requires constant vigilance and presents problems especially those of inspection and sterilization of pipe lines. For the solution of these problems, glass pipe and fittings offer a means of plant transport unique among all modern materials.

Possessing transparency, glass pipe lines inherently include one of the greatest aids to inspection. Design features of a piping system not apparent on the drafting board can be readily studied. "Pocketing" and other installation irregularities can be seen. Condition of dead ends, unused in some operations, is plainly visible.

In plants where a piping system conveys viscous products which adhere to pipe walls, it is especially important to note the thoroughness of a washing operation. Transparency permits this observation. It also facilitates modification of cleansing operations which may mean worthwhile economies in the use of steam or hot water.

In those instances where mixtures are conveyed and where there is any tendency to sedimentation, quality and the effectiveness of a mixing operation can be observed quite readily. Continuous observation proves a valuable supplement to intermittent sampling.

Also visibility is impressive to the customer. Every day is visitors' day in the plant with transparent piping and "a plant without secrets," substantially increases customer confidence in the foods produced.

Supplementary to transparency in dictating usages for glass pipe is the hard, chemically inert surface of borosilicate glass. It is identical with that used for analytical chemical apparatus and for piping in the heavy chemical industries; the resistant nature of its surface has been well demonstrated. Fruit and food acids have practically no effect. The hard, smooth surface remains undamaged throughout an indefinite life and insures food quality.

For general application to piping systems in the food and beverage industries, glass piping is suitable for service pressures up to 50 lb. per sq.in. Hot or cold liquids over the entire range of food processing temperatures are conveyed with assurance that the quality resulting from careful selection of materials and tried recipes will be maintained in the piping system.

Ceramic Materials

Corrosion-Proof, Sanitary

FOOD manufacturers frequently call on ceramic materials when they need something that will withstand severely corrosive chemical conditions. And well they may, for chemical stoneware and brick are impervious to even the most destructive of chemicals, excepting only hydrofluoric, which has no application in the food field, and concentrated hot caustic. But like all good things, ceramic materials have their limitations. Chemical stoneware, so effective against corrosion, goes to pieces comparatively easily when subjected to mechanical or heat shock; though, of course, acid-proof brick takes heavy loads and rough usage as a flooring material.

As plant equipment, ceramic material is being used by manufacturers of mustard, mayonnaise, soups, bouillon cubes, ginger ale, vinegar, fruit juices and many similar products. As a material for floors, walls and even table tops, it finds its way into a great many other food plants, such as those in the dairy, candy, and meat packing fields.

It is said that few engineers appreciate the range of properties obtainable in the various chemical-ware bodies. According to one expert in the field, there is possible a variation of from 100 to 300 per cent in certain of the physical characteristics. There are approximately fifteen different ceramic bodies, differing as to the raw clays, grogs, ground siliceous material, feldspars, quartz and the various chemicals that must be blended to get the desired physical, thermal, and chemically resistant properties of the finished product.

One well-known manufacturer offers seven different body textures, ranging from a very porous and open material intended to withstand sudden temperature changes to a very fine, dense substance vitrified almost to a glass texture. These seven different types are supposed to meet all different operating conditions.

Important among the physical limitations of chemical stoneware is the small abrupt change permissible in the temperature to which it is subjected. For ordinary material, some manufacturers advise a rate of change not exceeding 2 deg. C. per minute, unless it be possible to heat the entire ware evenly, and this generally holds also for acid-proof ceramic masonry. A quick temperature change over a relatively small range is more destructive than a wide change made more slowly.

There also is a limit to the degree of heat to which chemical stoneware should be subjected, regular stoneware bodies not being suitable for use above 100 deg. C. Special bodies, which are most costly, can be made to handle higher temperatures and more severe heat shocks. There have been developed a number of new ceramics which are said to equal cast-iron in their ability to withstand sudden temperature changes.

ALTHOUGH ceramic materials break comparatively easily, it should not be taken for granted that they are fragile. That they will withstand a fair amount of stress and strain is evidenced from the fact that they are used in such rotating equipment as mixers, agitators and even centrifugal pumps.

In considering the strength of stoneware, these figures may be helpful: maximum ultimate tensile strength, 7,500 lb. per sq.in.; maximum ultimate compression, 117,000 lb. per sq.in.; maximum ultimate bending strength, 14,000 lb. per sq.in.; maximum ultimate strength in torsion, 4,600 lb. per sq.in.; thermal conductivity in B.t.u. per sq.ft. per deg. F. per hour, 0.8 to 26.4; coefficient of thermal expansion per deg. F., 0.083×10^{-6} to 2.4×10^{-6}.

In selecting ceramic material for a particular application, it should be kept in mind that large pieces are more costly than an equivalent number of smaller units, because of difficulties encountered in the manufacturing process. For example, it is possible to make an 800-gal. storage tank in one piece, but an equivalent number of smaller sizes usually is more desirable. Or, in the particular case of the tank, an alternative is to use a steel, concrete or wood tank lined with chemical stoneware brick, vessels of this type being practically unlimited in size and shape.

Another important consideration in selecting ceramic ware is to use shapes and sizes standard with the manufacturer. If the material must be specially built, it naturally involves greater expense. Furthermore, an installation should be designed by someone familiar with the basic characteristics of ceramic materials and should be made for the particular operation in which it is to be used. This means close cooperation between user and manufacturer.

OF ALL the ceramic materials available, hard brick and tile probably find the greatest use in the food field. Brick floors have been found satisfactory, not only for their resistance to disintegration by corrosive substances but for their longevity under hard trucking service. In many plants, the trucking aisles are floored with brick, even when other materials are used elsewhere. In plant parlance, there are two kinds of ceramic flooring, smooth and rough. Both have a hard surface and wear well, but the smooth cleans the more easily, while the rough gives a more sure footing when wet or greasy. As to which should be used depends on personal preference and plant conditions. Good footing is important in some plants, not only to avoid hazards to employees, but to enable the workers to handle loaded trucks with ease. In one meat plant, where the floors are smooth and sloped to drain, two workers are required to move trucks that could be handled by one with good footing.

Glazed tile, as well as hard brick, is used in many plants in surfacing walls exposed to corrosive fluids or fumes or to steam and moisture which would quickly damage painted walls. Smooth tile walls also are quite popular in the dairy and other food industries where frequent cleaning is desirable or where the management wants to make the plant a showplace that will impress visitors with the high degree of sanitation maintained in the manufacturing processes. The smoothness of the tile makes it easily sterilized with hot water or steam, a factor important in plants where bacterial contamination is a problem.

Rubber Products

Find Increasing Use in Food Manufacture

By A. E. JUVE

Mechanical Goods Technical Division, B. F. Goodrich Co., Akron, Ohio

RUBBER products used in the food industry may be classified as (1) those used in industry in general such as hose; rubber-lined pipe and equipment; packing and gaskets; and transmission, conveyor, and elevator belting; and (2) those peculiar to use in the food industries and requiring special attention by the manufacturer and the rubber technologist.

Products used in the latter service include all those in which the rubber comes into actual contact with food during the process of manufacture. In this connection arise problems of contamination, discoloration, taste, toxicity, odor, or sterility.

On the subject of toxicity there is nothing in the literature to indicate that the rubber hydrocarbon is toxic. In fact, purified rubber has been used for chewing gum and ordinary vulcanized rubber has been proven nontoxic by its use in (*a*) dental plates, (*b*) artificial larynxes, (*c*) surgical gloves, and (*d*) nipples for nursing bottles. Toxic materials such as lead compounds, zinc compounds, antimony sulphides, and various organic materials are commonly used in rubber technology. While the extractability of these materials by body fluids or the weak solutions ordinarily encountered in the food industries is still an unsettled question, the general practice is to avoid these materials as much as possible in the manufacture of rubber for surgical purposes and for contact with foods. Usually small quantities of zinc oxide are used to activate vulcanization but the concentration is so small that the extraction of any quantity by even a strong solvent for zinc oxide is a remote possibility.

Purified rubber has practically no odor. Crude pale crepe, smoked sheet, off-grade, and wild rubbers have characteristic odors and for this reason are seldom used in goods intended for food processing equipment. Also vulcanized rubber usually has a distinctive odor. Recent investigations have shown that this results from the action of sulphur, or sulphur containing organic ingredients, with proteins which are present in small proportions in all crude rubbers. By a suitable choice of rubber and compounding ingredients, this effect can be greatly reduced.

Except in special cases, preventing materials being handled from acquiring a taste from the rubber is usually a specific problem. From this standpoint a composition which is suitable for milking machine diaphragms might not be satisfactory for a beer hose tube or vice versa. A notable demonstration that the taste acquirement problem can be solved satisfactorily is shown in the development of the rubber ice-cube tray.

Contamination may occur as the result of extraction of some constituent of the rubber mix by the solvent action of the food material being handled, or as a result of the physical deterioration or abrasion of the rubber, in which case particles of rubber are the contamination. Both conditions may be eliminated or greatly helped by careful adjustment of the rubber composition to suit the need. Rubber is quite frequently used to prevent contamination which would occur if some other material of construction were used. Rubber-lined pipe is therefore often used.

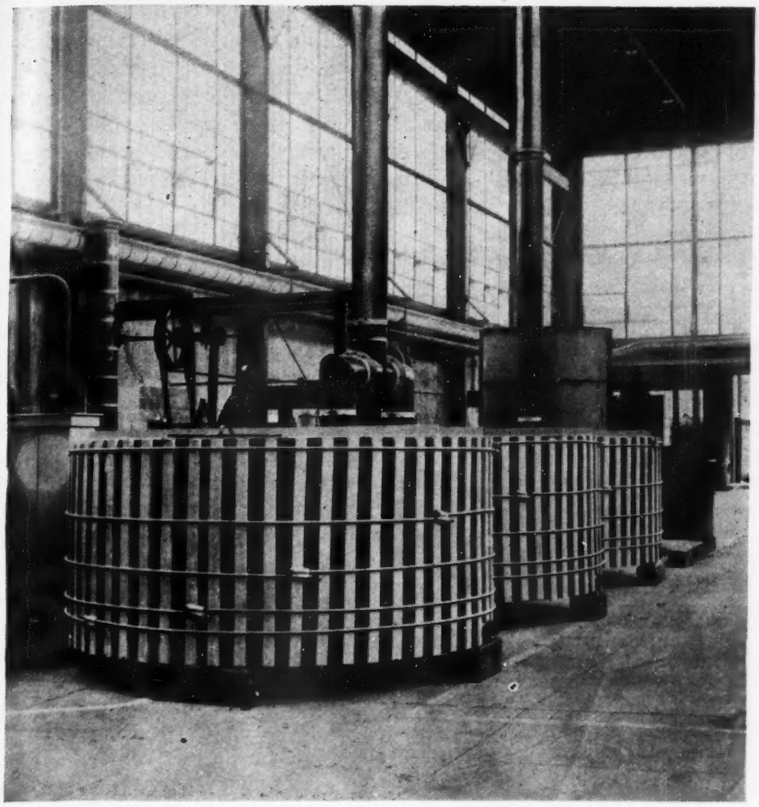
Discoloration occurs either from the chemical action between one of the constituents of the rubber composition and the material being handled to form a soluble colored compound or, as is usually the case, one of the constituents is extractable by the material being handled, and gives a colored solution. Special mixes can be designed to correct these difficulties.

In cases, such as milking-machine tubing and diaphragms and beer hose, frequent sterilization is necessary. In developing mixes for these uses the sterilization requirement is kept in mind so that the mix can be adjusted to prevent the resulting rubber from deteriorating too rapidly under heat treatment.

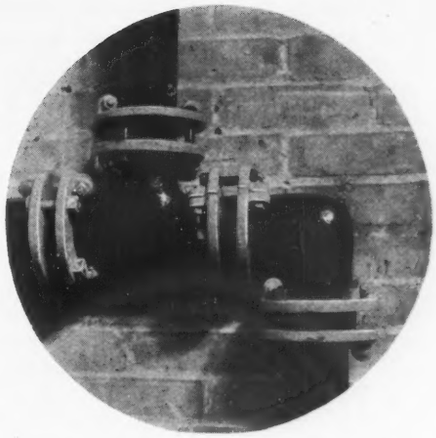
THE foregoing comments cover the principal features in the formulation of a rubber compound which a rubber technologist must keep in mind when making up a product for particular use. It might be pointed out here that, by the judicious selection of the ingredients, the characteristics discussed can be developed in almost any type of rubber compound from a soft flexible pure-gum type rubber to a straight hard rubber. Any particular development resolves itself into an analysis of the conditions of use and the determination of the physical properties required of the rubber. Development of a mix adjusted to give these properties, plus the special requirements of odor, taste, discoloration, and non-toxicity dictated by the requirements of the service, then follows. A few items from a varied line of rubber products for the food industry are:

(*a*) brewers hose, furnished with a white, easily cleaned, sanitary cover, specially developed so as not to impart taste, taint or odor to the brew;
(*b*) wine hose, similar to the brewers hose, and used by wineries for the handling of their product in its various stages of manufacture;
(*c*) cider and vinegar hose, impervious to acids (except strong oxidizing acids), hot or cold liquids, and low pressure steam;
(*d*) suction hose, a heavy duty hose used for the unloading of bulk molasses from ships;
(*e*) beverage hose, used on bottle filling machines by beverage and food product manufacturers and also widely used in connection with beverage dispensing equipment;
(*f*) conveyor belts, used for handling fruits, vegetables, meat, fish, bread, cereals, salt and sugar;
(*g*) canning conveyor belts, made with a white cover to promote cleanliness and facilitate efficient sorting, constructed to be easily and quickly cleaned with soap and water, and having characteristics to make them waterproof and impervious to the action of vegetables and fruit juices;
(*h*) special belts with friction surface for conveying boxes, bottles, packages and light loose materials;
(*i*) rubber lined tanks, pipe, valves, and fittings made practical by the development of the patented Vulcalock Process, whereby soft rubber can be attached directly to the surface of metals with an adhesion exceeding 500 lb. per square inch.
(*j*) flexible molds for candy;
(*k*) milking machine tubing and diaphragms;
(*l*) sealing rings, jar rings, bottle cap gaskets and can rubbers;
(*m*) rubber cements and latex for sealing tin cans.

Rubber lining of metal equipment and fittings makes possible the handling and storage of mustard and corn syrup as well as acids and other products to which contact with metal is undesirable. One manufacturer of evaporated milk has equipped his plant with rubber-coated evaporating pans.



These 9-ft. phenolic resinoid (Haveg) tanks are reinforced by steel bands. They are installed in a baking powder plant.



Phenolic resinoid pipe joints are held together by a special locking device.

Plastics

Find increasing utility in food equipment and food plant accessories construction

By JAMES A. LEE
Managing Editor, Chemical and Metallurgical Engineering

THE most important group of the recently developed plastic materials is the synthetic resins. One of the first of these products to be made available was the phenol-formaldehyde resinoid, commonly known by such names as Bakelite, Durez, Micarta, Haveg, and so forth. As the most prominent representatives of this class of resins, the phenolic resin displays some especially interesting properties.

The phenolic resin is available in almost any shape or size required, either as molded or laminated products. Although it is not generally known, large pieces of equipment made of this material are now in use for tanks, kettles, stills, and the like. Phenolic resin has been satisfactorily used for handling acetic, lactic, oxalic, citric, phosphoric, and tartaric acids. Ammonia, milk of lime, sodium carbonate, and neutral soap solutions do not affect them, nor do the common solvents such as ethyl alcohol and carbon tetrachloride. Salt, vanillin, and fatty acids are not harmful to the resin. On the other hand it should not be used where caustic soda and other strong alkalis are present. In the food industry it has been used for the handling of vinegar, in the manufacture of baking soda, and in various other instances; but these products should be used in this industry with caution because they usually contain residual traces of phenolic bodies, which tend to produce tastes and odors in the products. In many instances this has not proved to be serious, and it can usually be minimized by boiling the equipment out with water.

ONE type of phenolic resin that is on the market has a compressive strength of 10,400 lb. per sq.in., bending strength 5,600 lb. per sq.in., and high resistance to shock. The specific gravity is 1.6. This material may be used at temperatures up to 130 deg. C. and may be cooled from this temperature to the freezing point without cracking; it is not affected by rapid temperature changes, and hot and cold liquids may therefore be used in rapid succession without danger of fracture of equipment. It does not suffer from long use at 120 deg. C. or at very low temperatures.

This resin has a close, impervious, homogeneous structure and a smooth surface, which makes cleaning easy. The surface is non-absorbent and the material is tough and does not deteriorate easily. Therefore, it permits savings in repairs and replacements with their accompanying loss of time. It may be allowed to remain idle for long periods of time without deterioration and may be again placed in operation without delay.

It is easily machined and may be cut, drilled, planed, turned, and the like. New inlet or outlet connections may be fitted into equipment in place, and outlets no longer required may be easily sealed.

A resin closely related to the type previously discussed is the urea-formaldehyde, known on the market by

such names as Beetle and Plaskon. This is a more recently developed resin, first produced in 1926 in England, but not until 1929 was the American product on the market.

This urea resin without filler is perfectly clear, transparent, and odorless. Light has no ill effect on it. The weight is about one-half that of glass, with which it is often compared. Although the urea resin is being used in some of the fields formerly served by the phenolic resinoid, its principal possibilities appear to be in applications not previously covered by this other type of resin. Freedom from odor commends it for uses to which phenolic resinoids are not applicable. Its resistance to water is now very nearly equal to that of the other resin.

This new plastic, the urea resin, is not appreciably acted upon by mineral or vegetable oils. It is unaffected by alcohol, acetone, or other common solvent. Urea resins are quite resistant to cold dilute alkalis and hot, very dilute alkalis, such as soap, borax, cleaners, etc. These resins can be machined, bored, resurfaced and polished. They are available in the clear, filled and laminated forms.

Another new synthetic resin that has come forward during the depression is the vinyl type known as Vinylite. This resin is clear or transparent and suffers no change in the light, so that pure whites which remain colorless may be easily obtained. It is without odor or taste and is insoluble in alcohols. Its water absorption is low.

Vinyl resin may be extruded in the form of rods, tubes, or sheets, and stamped into various forms. A low coefficient of heat-expansion makes possible the molding of large objects without subsequent distortion. It is non-inflammable. The vinyl plastic is new, but its properties suggest a broad field of future application.

THE cellulose plastics include two distinct groups; the cellulose nitrate plastics and the cellulose acetate plastics.

The cellulose nitrate plastic has been used to some extent for process industry equipment but, because of its conspicuous shortcoming, inflammability, this type of application is somewhat limited. Numerous methods have been tried without success to eliminate this disadvantage, while retaining all the desirable qualities of this plastic.

However, if nitrocellulose plastic is highly inflammable, the cellulose acetate plastic is not. It supports combustion with difficulty, burning like hard rubber or wood. The acetate plastic is slightly more expensive than the nitrate but, combining some of the qualities of nitrocellulose with that of non-inflammability, cellulose acetate, although more brittle and less water resistant, has its own valuable uses.

The acetate plastic is uninjured by contact with either vegetable or mineral oils. Essential oils and alcohols are partial solvents and will soften or spot the surface of a molded piece. It should not be subjected to acids or alkalis of strength in excess of ½ of 1 per cent.

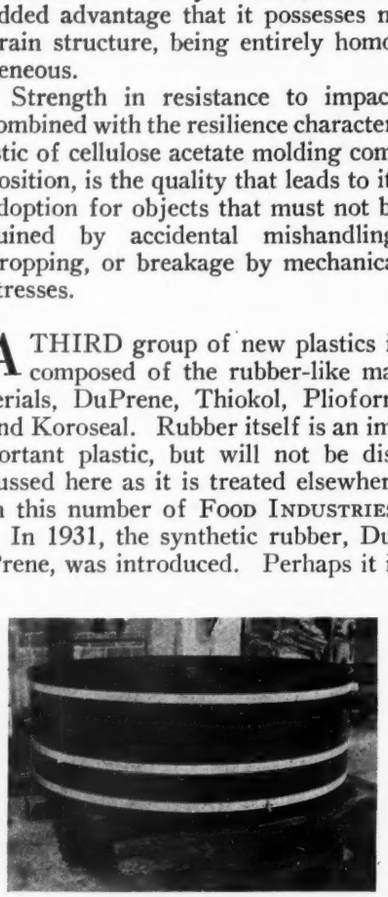
Products molded from the acetate are unaffected by ordinary temperatures. Subjection to temperatures of 160 deg. F. or higher, depending somewhat on the degree of flow, will cause softening. Slight shrinkage in thin-walled pieces takes place under continued heat of more than 140 deg. F.

The acetate article can be turned, punched, or sawed with ease. Drills commonly used for wood are best suited to the acetate molded object. It machines as easily as wood, with the added advantage that it possesses no grain structure, being entirely homogeneous.

Strength in resistance to impact, combined with the resilience characteristic of cellulose acetate molding composition, is the quality that leads to its adoption for objects that must not be ruined by accidental mishandling, dropping, or breakage by mechanical stresses.

A THIRD group of new plastics is composed of the rubber-like materials, DuPrene, Thiokol, Plioform and Koroseal. Rubber itself is an important plastic, but will not be discussed here as it is treated elsewhere in this number of FOOD INDUSTRIES.

In 1931, the synthetic rubber, DuPrene, was introduced. Perhaps it is most valuable because it is much more resistant than natural rubber to the swelling action of gasoline, kerosene, and other solvents that are notoriously harmful to rubber. DuPrene is also much more resistant to oxygen and many other chemicals that attack rubber.



The baking powder industry uses Haveg (phenol-formaldehyde resin) 9 ft. diameter tanks of this type for evaporation service.

In March, 1933, the new resin made from rubber hydrocarbon, Plioform, was first announced. Its resistance to moisture and various chemicals, along with its low specific gravity (1.06), are some of the properties which have been of interest to the engineer. Objects molded from this resin indicate that its low moisture absorption will make it outstanding as a material from which to mold containers for liquids. Its resistance to alkalis and acids also make it of interest in this field. The fact that this material contains no sulphur, yet is a rubber derivative, enables it to replace hard rubber in a number of chemical uses.

Koroseal is a synthetic rubber-like material made in a variety of compounds ranging from bone-like hardness to a liquid. However, we shall consider only the solid forms. Inasmuch as this plastic costs more than rubber, its usefulness is based on certain important properties in which it is superior to rubber.

It is particularly interesting to the food industry as it is tasteless and practically odorless. Because of its inert character, Koroseal is valuable in its freedom from contaminating effect in processing of food products or other materials in which a high degree of purity is essential. When it is intended for such service, the conditions should be specified by the buyer so that the proper plasticizer and pigments may be selected.

The useful temperature range of Koroseal compounds is from —15 deg. F. upward to about 150 deg. They are resistant to sunlight and show high resistance to oxidation. They are far superior to rubber in respect to water absorption.

It exhibits one of its most remarkable properties in its resistance to swelling and disintegration in the presence of vegetable and mineral oils. It is said to be resistant to alkalis in all concentrates and all temperatures, 10 per cent sodium hydrochlorite, oleic, and lauric acids.

Hard compounds of the material can be readily machined, drilled, sawed, or cut. They range in specific gravity from 1.25 to 1.4. The harder compounds have a tensile strength of 7,500 lb. per sq.in.

Paints and Painting

To protect the equipment and plant interior from corrosion, paints must be chosen and applied with care

By VICTOR BUHR
Equity Construction Co., New York, N. Y.

MANY are the problems encountered in painting and repainting food plants and equipment, and to minimize maintenance costs the same care must be taken in selecting and applying paints as in the preparation and mixing of food products.

When a new structure is erected and has received its initial coatings of paint, one should not expect the paint to hold the building together nor expect that the dampness, salts and whatnot will remain inert simply because the surface has been covered. It will be necessary to repaint a plant, or at least the principal portions thereof, within a year or two after its completion. This does not mean that any kind of paint should be used indiscriminately for the initial coating, simply because it has to be done over again.

The kind of paint to be selected depends, of course, on the character of the surface to be covered, the nature of the business and the type of work done in the individual departments. A certain type of paint may give excellent results on wood and prove unsatisfactory on a plastered or metallic surface. The paint must have ingredients so blended as to afford good cohesion with the surface to which it is applied; and because the degree of absorption varies with the nature of the surface, the kind of paint used and its consistency must be selected accordingly.

The proper undercoating is very essential, and on new metal work there is nothing that can take the place of pure red lead mixed in oil. When paint on metal work scales or blisters, red lead again is the most satisfactory material for touching up these defective parts as an undercoat for the finishing paint. Many paint manufacturers claim to have substitutes the equal of pure red lead, and they can often produce laboratory results confirming their assertions. No doubt these paint makers are sincere in their representations, but, in our experience, there is no substitute for genuine red lead ground in oil.

In a food plant there often are fumes or vapors detrimental to paint finishes. Where such a condition exists, the paint manufacturer can often provide a special paint which will resist the destructive action to a large degree. When a process involves intensive stages of fermentation, it will be found advisable to treat, with a chemical mixture prepared for that purpose, all exposed surfaces that are to be painted. This will greatly assist in eliminating the formation of mold and other fungus growths that frequently develop and prove annoying and expensive to remove.

Paint should never be applied to a wet surface or to damp walls. Frequently, however, it is not desirable to leave plastered walls bare for the time it takes them to dry. While there is no paint or any compound that will stand up on a damp plastered surface, peeling can be considerably minimized by sponging the surface with a solution of zinc sulphate. This tends to neutralize the action of lime in the plaster.

Repainting is not only an expense, but a nuisance. So in some departments where the process employed tends to discolor the paint, it may be advisable to tint the painting medium to correspond to the discoloration. In repainting, it often is economical to do the job with a spray. Before doing this, however, it is well to check with local health regulations and the degree of union jurisdiction over your plant. If spray painting is decided upon, care should be taken to protect adjoining surfaces. When plant help is used to do a paint job, they should be given proper instructions in handling the spray, or brush.

In building a plant and later on, in maintaining it, it is well to establish the colors that are to be adhered to and to prepare a manual specifying the paints to be used. This will insure uniform colors and provide a systematic basis for repainting.

In rooms where there is a constant escape of steam or where a great deal of condensation takes place, it is advisable to install materials of a vitreous character, such as enameled tile or brick. Though more expensive at the outset, this will frequently save money over a period of years by eliminating the cost of repainting.

Most manufacturers of equipment do a good job of painting their machinery in the shop. If, however, the finish is marred in shipment or installation, it should be carefully retouched, preferably by the manufacturer. The same kind of paint and the same number of coats as originally used should be employed in retouching. For a lasting finish and the elimination of painting or repainting, many non-staining and non-corrosive metals are available for use in equipment.

IN former years, there was only one paint to consider if a real job was wanted, and that was pure lead and oil with a thinner of turpentine. This still holds good, although it must be acknowledged that paint manufacturers have made strides which enable them to produce good paint at a cost much below that of lead and oil.

There are many good paint manufacturers, and quite a few of them have separate departments specializing in technical and industrial paints. It is well to consult a representative of such a concern before buying your paint. Then have it put on by a man who knows his job.

Paints

for Plant and Equipment

By R. C. SHEELER
E. I. du Pont de Nemours & Co., Inc.,
Philadelphia, Pa.

Application of the proper paint would have prevented the corrosion of this metal window sash by the vinegar fumes of a pickle factory. Badly damaged, the metal sash was replaced by a wooden one.

PROPER preparation of surfaces to be painted cannot be neglected without damaging results, and each type of surface presents problems of its own. For instance, wood surfaces exposed to high heat and humidity are likely to develop rot and decay rapidly. Maintenance of such surfaces is all the more complicated by the fact that much of the painting must be done without interfering with production schedules. The difficulty of surface preparation is apparent. Likewise, the fruitlessness of applying coats of paint or enamel over surfaces impregnated with moisture is beyond contradiction.

On concrete or cement, the problem is equally difficult inasmuch as these surfaces likewise absorb moisture. This in turn activates whatever alkali is present in the structure, bringing it to the surface, resulting in a saponification of the oils in the paint film and consequent early breakdown.

Steel and other metal surfaces require equally careful preparation. Rust, the great enemy, is always alive to its opportunity to attack any unprotected metal surface. Often a blow-torch is used to dry off the surface, after a vigorous wire brushing or scraping. For, once again, unless metal surfaces are dry at the time of painting, a new coat of a rust-inhibitive primer or paint will do very little to protect and preserve. The rust and corrosion in the presence of moisture underneath the paint will go ahead without hindrance and unperceived, until when too late, the strength of the unit will be practically destroyed.

Of even greater importance than surface preparation is the selection of suitable finishes for various surfaces. Exterior surfaces do not, as a rule, cause much concern. These are adequately provided for by a wide range of finishes of many types. But the selection of the one best coating to meet the peculiarities of each interior surface is not so easy.

IN the order of their importance, maintenance materials should be selected on the basis of: (1) durability; (2) ease of cleaning; (3) light reflection; (4) resistance to discoloration; (5) adaptability to the peculiar conditions in the plant.

All products do not perform equally well in all plants. In certain bakeries, for example, wall and ceiling surfaces are subject to a deposit of fats; sugar and other substances. While there may be no way to prevent such a deposition, there are white or light-colored finishes available which are more resistant to permanent discoloration under these conditions. The brownish film may be readily removed from such finishes by frequent washing with a mild alkaline cleanser, and the finish itself, if properly chosen, will show but little color change.

One of the most prevalent and harassing problems is that of preventing or overcoming mildew on walls and ceilings. Mildew is really a microorganism which feeds upon the fats and oils in the paint film, and its spread is aided by the sometimes imperceptible vapors arising from food processing. Its control may be greatly facilitated by surface coats containing ingredients which inhibit the growth of mildew.

Among the surface coatings of value in plant and equipment maintenance are those of a synthetic nature. These are of wide variety and no longer are in their experimental stage. Synthetic resin products are available today which far outstrip undercoats and enamels of the kind formerly used. Among these are finishes which include such favorable features as exceeding whiteness, strong resistance to discoloration, unusual hiding power, ease of application, ability to withstand frequent washing, retention of high light-reflecting ability and ultimate economy of use. While many plant engineers prefer white, other shades may be obtained in these coatings, including aluminum of high light-reflecting ability.

MACHINERY and equipment call for surface protection of a special type. These are frequently exposed to a mixture of water, fruit acids and cleaning solutions of an alkaline nature. Outstanding progress has occurred in the manufacture of enamels which more nearly meet these severe requirements, so that it is possible today not only to protect expensive equipment from deterioration but to add greatly to the appearance of the plant itself.

That surroundings have a profound effect upon morale and a high standard of production is beyond dispute. The intelligent application of paints and enamels is reflected in good housekeeping, in increased efficiency and in quality standards which more than pay for the monetary outlay.

Materials of Construction

for Food Processing Equipment and Structures

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THE following tabulation lists many of the important properties and characteristics that must be considered in the selection of suitable materials for the fabrication of food plant machinery and accessories, and for those parts of the plant buildings that are affected by the operations of food processing.

In addition to the information given in these tables, there are other properties and characteristics that play a part in material selection, but which have been omitted. Some of these do not appear because they are of importance only to machine designers. In other cases, only one or two materials are concerned, and the omission is for uniformity. In still other cases, available data did not warrant inclusion, being still subject to experimentation and definite determination.

Much information not included in the tables is briefly discussed in the articles on the individual groups of materials that precede these tables. The materials tabulated appear in the following order:

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Other Alloy Metals ..... **Page 608**
Synthetic Plastic Materials ..... **Page 610**
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METALS

Product Trade or Common Name	Name of Manufacturer Supplying Data	Composition by Per Cent	Specific Gravity or Weight	Melting Point Degree F.	Thermal Conductivity	Tensile Strength lb./sq.in.	Elongation % in 2 in.	Brinell Hardness	Resistance to Abrasion	Resistance to Corrosion	Solubility in Food Ingredients	General Applications	Possible Methods of Fabrication	Forms in Which Available
						Form for which these properties are recorded indicated by letters referring to key at end of table								
Cast iron (Gray Iron)	Various sources	C. 3.00-3.25; Si. 1.00-2.00; S. .10; Mn. 0.75-1.25; Fe.	7.03–13 gm./c.c.	2200 ±	322 B.t.u. per hour per sq.ft. per in.	C 20,000-24,000	C 0.1 to 1.0	149	Good	Resists anhydrous and strong acids, also alkalis. Corroded by all acids in solution	Soluble to varying deg. in all acids	Machine frames and other parts. Structural	c., w.	C
Cast Iron (Malleable)	The Dayton Malleable Iron Co. Dayton, Ohio	C. 2.50; Si. 0.90; Mn. 0.30; Fe.	7.15–45 gm./c.c.	2200 ±		C 54,000	C 20.0	112 to 140		Like gray cast iron, but less pronounced in resistance	Like gray cast iron	Machine parts, particularly moving parts	c., r.	C
Cast Iron "Meehanite"	Licensees of the Meehanite Metal Corp. Pittsburgh, Pa.	Si. 1.25; Fe.; C.; etc.	7.49 gm./c.c.	2200	135 cal. per cm. per sec.	C 50,000 cast 70,000 HT	C 1.5	160 to 600	Good	Three to six times more resistant than gray cast iron	Low in food acids and ingredients	Machine parts and frames	c., p., br., s., w.	C
Genuine Wrought Iron	A. M. Byers Co. Pittsburgh, Pa.	C. 0.05 or less; Mn. 0.05; P. .10 to .12; S. .03; Si. .10 to .15; Slag 3 to 4; Fe.	480 lb. per cu.ft.	2780	418 B.t.u. per hour per sq.ft. per in.	B 48,000	B 22 per cent in 8 in.	97		Corrosion by moisture and food ingredients, depends on concentration and temperature conditions Good base for coatings	See resistance to corrosion —Same	Pipe Machine parts. Structural details Tanks	b., br., d., f., fr., p., r., w.	B, FR, HR, S, T, R Plates
Armco Ingot Iron	American Rolling Mill Co. Middletown, Ohio	S. 0.025; Mn. 0.017; C. 0.012; P. 0.005; Fe.	7.86 gm./c.c.	2785	0.16 c.g.s. units	S & P 48,000		80 to 120		High to atmospheric corrosion. Good base for resistant coatings	Soluble to varying degree in food acids	Enameled and coated sheets. Structural Details	b., d., dd., f., r., w.	B, CR, HR, S, T, R, D
Ordinary Mild or Low Carbon Steel	Various sources	C. 0.15 to 0.25 Fe	7.9 gm./c.c.	2550 ±	313 B.t.u. per hour per sq.ft. per in.	B 76,000	B 24	152	Good	Corroded by moisture and food ingredients, depending on concentration and temperature conditions	Soluble to varying degree	Structures. All parts of equipment where iron contamination not important	b., c., f., d., fr., r., w., p.	B, C, CR, FR, HR, S, T, R
Aluminum 2S (Commercially Pure)	AluminumCompany of America Pittsburgh, Pa.	Al. 99+	0.098 lb. per cu.in.	1202–11 Melting Range	0.53 c.g.s. units at 100° C.	$\frac{1}{16}$ in. S 24,000 H 13,000 ST	$\frac{1}{16}$ in. S 5 H 35 ST	44 H 23 ST		Resistant to food ingredients. Attacked by chlorine and strong alkalis	Practically insoluble in food ingredients	Equipment (alloys used for machines and structural elements)	d., dd., f., fr., p., r., s., w., e.	B, C, CR, D, FR, HR, T, R, S, Foil
Copper	American Brass Co. Waterbury, Conn.	Cu. 99.9	.322lb. per cu.in.	1981	0.94 c.g.s. units at 20° C.	S 50,000 H 30,000 ST	S 4 H 37 ST	103 H 42 ST		High to atmosphere and water. Good to food ingredients when air or oxygen is not present	Slight when air (oxygen) is absent	Tinned when used in food equipment. Used for water pipe	b., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Nickel	The International Nickel Company, Inc., New York, N. Y.	Ni. 99+	8.8 gm./c.c.	2624	0.14 c.g.s. units 0–100 deg. C.	C R D 65,000 to 115,000	C R D 5 to 45	Annealed = 115–130 hard = 190 to 220	Good	Notably resistant to a wide range of corrosives		Processing equipment and machines	b., br., c., d., dd., f., fr., r., s., w., p.	B, C, CR, D, FR, HR, S, T, R
Silver	Various sources	Ag. 99.9	10.53 gm./c.c.	1761	1.0 c.g.s. units at room temp.	S 41,000 H 23,000 ST	S 3 H 35 ST	38 ST		Good where sulphur is absent		Pipe Platings	b., d., dd., r., f.	B, C, CR, D, S, T
Zinc Alloy (Die Cast)	The New Jersey Zinc Co. New York, N. Y.	Zn. 93.17 Al. 4.1 Cu. 2.7 Mn. 0.03	6.8 gm./c.c.	736	0.25 per cm^2 per sec. per °C.	B 47,900	B 5.1	83		Resistant to atmospheric moisture and weak alkaline solutions	Soluble. Should not be used in contact	Die cast machine and accessory parts	Die Casting	Die Casting

Methods of Fabrication: b. = brazing; br. = burning; c. = casting; d. = drawing; f. = flanging; fr. = forging; r. = riveting; s. = soldering; w. = welding; dd. = deep drawing; p. = polishing; ex. = extruding.
Forms Available: B = Bar; C = Casting; CR = Cold Rolled; D = Drawn; FR = Forging; HR = Hot Rolled; S = Sheets; T = Tubing; R = Rods.
Key To Forms Tested: HT = Heat Treated; Cast = As Cast; H = Hard Temper; ST = Soft Temper; CRD = Cold Drawn Rod; B = Bar; C = Cast Bar; S = Sheet; P = Plate.
Note: Where name of manufacturer is given, data applying to that metal has been supplied by the manufacturer named.

FERROUS ALLOYS

Key To Forms Tested: HT = Heat Treated; CR = Cold Rolled; HR = Hot Rolled
Note: Where name of manufacturer is given, data applying to that metal has been supplied by the manufacturer

FERROUS ALLOYS

Recommended by Manufacturers for Use in Food Plants

Product Trade or Common Name	Name of Manufacturer Supplying Data	Composition by Per Cent	Specific Gravity or Weight†	Melting Point Degree F.	Thermal Conductivity	Tensile Strength lb. per sq.in.	Elongation % in 2 in.	Brinell Hardness	Resistance to Abrasion	Resistance to Corrosion	Solubility in Food Ingredients	General Applications	Possible Methods of Fabrication*	Forms in Which Available**
						Form for which these properties are recorded indicated by letters referring to key at end of table†								
Allegheny Metal, Grade A, No. 304	Allegheny Steel Co. Brackenridge, Pa.	C. .11; Mn. .50; P. .025; S .025; Si. .50; Cr. 17-19; Ni. 7-9.	7.97-8.07 CR 7.86-7.94 HR	2606-2679	.069 cal. per cm per sec. per deg. C. (20-100)	85,000	69	233 HR	Yes	Unaffected by food acids, salts, etc.; and by cleansing agents. Resists moisture	Practically none	Food equipment and accessories. Structural details	b., dd., f., d., r., w.	B, CR, D, HR, P, S, T
Allegheny Metal, Grade B, No. 305	Allegheny Steel Co. Brackenridge, Pa.	C. .08-.20; Mn. .50; P. .025; S. .025; Si. .50; Cr. 18-20; Ni. 8-10	7.97-8.07 CR 7.86-7.94 HR	2606-2679	.069 cal. per cm. per sec. per deg. C. (20-100)	85 000	69	233 HR	Yes	Unaffected by food acids, salts, etc.; and by cleansing agents. Resists moisture	Practically none	Food equipment and accessories. Structural details	b., dd., f., d., r., w.	B, CR, D, HR, P, S, T
Allegheny Metal, Grade B, Special No. 306	Allegheny Steel Co. Brackenridge, Pa.	C. .11; Mn. .50; P. .025; S. .025; Si. .50; Cr. 18-20; Ni. 8-10	7.97-8.07 CR 7.86-7.94 HR	2606-2679	.069 cal. per cm. per sec. per deg. C. (from 20-100)	85,000	69	233 HR	Yes	Unaffected by food acids, salts, etc.; and by cleansing agents. Resists moisture	Practically none	Food equipment and accessories. Structural details	b., dd., f., d., r., w.	B, CR, D, HR, P, S, T
Allegheny Metal, Grade C, No. 302	Allegheny Steel Co. Brackenridge, Pa.	C. .08-.20; Mn. .50; P. .025; S. .025; Si. .50; Cr. 17-19; Ni. 7-9	7.97-8.07 CR 7.86-7.94 HR	2606-2679	.069. cal. per cm. per sec. per deg. C. (from 20-100)	85,000	69	233 HR	Yes	Unaffected by food acids, salts, etc.; and by cleansing agents. Resists moisture	Practically none	Food equipment and accessories. Structural details	b., dd., f., d., r., w.	B, CR, D, HR, P, S, T
Allegheny Metal, Free Machining No. 303	Allegheny Steel Co. Brackenridge, Pa.	C. .08-.20; Mn. .2-1.2; P. .17; S. .60; Si. .70; Cr. 17-19; Ni. 7-9	7.97-8.07 CR 7.86-7.94 HR	2606-2679	.069 cal. per cm. per sec. per deg. C. (from 20-100)	85,000	69	233 HR	Yes	Unaffected by food acids, salts, etc.; and by cleansing agents. Resists moisture	Practically none	Food equipment and accessories. Structural details	b., dd., f., d., r., w.	B, CR, D, HR, P, S, T
Allegheny 22 No. 307	Allegheny Steel Co. Brackenridge, Pa.	C. .08-.20; Mn. .50; P. .025; S. .025; Si. .50; Cr. 19-22; Ni. 9-12	7.97-8.07 CR 7.86-7.94 HR	2606-2679	.069 cal. per cm. per sec. per deg. C. (from 20-100)	85,000	69	233 HR	Yes	Unaffected by food acids, salts, etc.; and by cleansing agents. Resists moisture	Practically none	In equipment requiring maximum resistance to chemicals	b., dd., f., d., r., w.	B, CR, D, HR, P, S, T
Allegheny 22 Special No. 308	Allegheny Steel Co. Brackenridge, Pa.	C. .11; Mn. .50; P. .025; S. .025; Si. .50; Cr. 19-22; Ni. 9-12	7.97-8.07 CR 7.86-7.94 HR	2606-2679	.069 cal. per cm. per sec. per deg. C. (from 20-100)	85,000	69	233 HR	Yes	Unaffected by food acids, salts, etc.; and by cleansing agents. Resists moisture	Practically none	In equipment requiring maximum resistance to chemicals	b., dd., f., d., r., w.	B, CR, D, HR, P, S, T
Amsco Alloy 16-35 or F-1	American Manganese Steel Co. Chicago Heights, Ill.	Cr. 16; Ni. 35; C. .15-.50	7.9-8.2	2550-2700	.03 cal. per cm.² per sec. per deg. C.	50,000 to 70,000 cast 92,000 F	15-35 cast 35 F	150 cast 175 F	Yes	High resistance to food acids, salts; alkalis, cleansers, sterilizers, or other causes	Practically none	Food equipment and accessories	c., fr., w.	C, FR
Amsco Alloy 26-12 or F-10	American Manganese Steel Co. Chicago Heights, Ill.	Cr. 26; Ni. 12; C. .15-.45	7.9-8.1	2460-2600	.025-.04 cal. per cm.² per sec. per deg. C.	98,000 cast 112,000 F	37 cast 40 F	190 cast 225 F	Yes	High resistance, especially to common food acids. Enhanced by 2 to 3 per cent silicon	Practically none	Food equipment and accessories	c., fr., w.	C, FR
Amsco Alloy 28-03 or F3	American Manganese Steel Co. Chicago Heights, Ill.	Cr. 28; Ni. 0-3; C. 0.15-2.0	7.5	2550	0.059 cal. per cm.² per sec. per deg. C.	40,000-60,000 cast	0-2 cast	170	High with high carbon content	High resistance to food acids, salts, alkalis, cleansers, sterilizers, or other causes	Practically none	Food equipment	c.	C
Amsco Alloy 18-08 or F8	American Manganese Steel Co. Chicago Heights, Ill.	Cr. 18; Ni. 8	7.9	2460-2600	0.06 cal. per cm.² per sec. per deg. C.	70,000-80,000 cast	40-75 cast	230	Yes	High resistance to food acids, salts, alkalis, cleansers, sterilizers, or other causes	Practically none	Food equipment	c.	C

FERROUS ALLOYS

Recommended by Manufacturers for Use in Food Plants

Product Trade or Common Name	Name of Manufacturer Supplying Data	Composition by Per Cent	Specific Gravity or Weight	Melting Point Degree F.	Thermal Conductivity	Tensile Strength lb. per sq.in. / Elongation % in 2 in. — Form for which these properties are recorded indicated by letters referring to key at end of table	Brinell Hardness	Resistance to Abrasion	Resistance to Corrosion	Solubility in Food Ingredients	General Applications	Possible Methods of Fabrication*	Forms in Which Available**
Armco 18-8	American Rolling Mill Co. Middletown, Ohio	C. .12 max.; Cr. 17-19; Ni. 7-9	7.93	2550-2590	0.04 c.g.s. units	85,000 S / 60 S	150	Yes	High resistance to food acids, salts, alkalis, cleansers, sterilizers, or other causes	Practically none	Food equipment and accessories. Structural details	c., d., dd., f., fr., p., r., s., w.	S P Strips
Armco 17	American Rolling Mill Co. Middletown, Ohio	Cr. 17; C. 0.12 max.	7.71	2710-2750	0.05 c.g.s. units	75,000 S / 27 S	150	Yes			Food equipment	c., d., dd., f., fr., p., r., s., w.	S P Strips
B. & W. Croloy 18	Babcock & Wilcox Tube Co. Beaver Falls, Pa.	Cr. 15-18	7.67	2750	⅓ that of pure iron	75,000 T / 30 T	140-165	Fair	Resistant to food acids, salts, alkalis, cleansers, sterilizers or other causes	Practically none	Food equipment and accessories	c., d., dd., f., fr., p., r., s.	B, C, CR, D, FR, HR, S, T, R
B. & W. Croloy 18-8	Babcock & Wilcox Tube Co. Beaver Falls, Pa.	Cr. 18; Ni. 8	7.865-7.925	2550	121 B.t.u. per sq.ft. per in. per deg. F.	90,000 T / 65 T	130-160	Yes	High resistance to food acids, salts, alkalis, cleansers, sterilizers, or other causes	Practically none	Food equipment and accessories. Structural details	c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Bethadur 1	Bethlehem Steel Co. Bethlehem, Pa.	C. .11; Mn. .30; Cr. 12.50	7.688			75,000 / 34	143		Resists food ingredients, salts, cleansers, etc.		Food equipment and accessories	fr., p., s., w.	B, C, CR, FR, HR, S, R, P
Bethadur 2	Bethlehem Steel Co. Bethlehem, Pa.	C. .13; Mn. .30; Ni. 8.0; Cr. 18.0	7.89			95,000 B / 42 B	152 B		High resistance to food acids, salts, alkalis, cleansers sterilizers, and other causes		Food equipment and accessories. Structural details	fr., p., w.	B, C, CR, FR, HR, S, R, P
Bethadur 6	Bethlehem Steel Co. Bethlehem, Pa.	C. .40; Mn. .30; Si. .25; Cr. 14.00	7.75			120,000 B / 20 B	248 B		High resistance to food acids, salts, alkalis, cleansers, sterilizers, and other causes		Food equipment and accessories	fr., p., w.	B, C, CR, FR, HR, S, R, P
Bethalon A	Bethlehem Steel Co. Bethlehem, Pa.	C. .11; Mn. .30; Cr. 13.00; MoS_2 .50	7.777			74,000 / 30	156		High resistance to food acids, salts, alkalis, cleansers, sterilizers, and other causes		Food equipment and accessories	fr., p.	B, FR
Bethalon B	Bethlehem Steel Co. Bethlehem, Pa.	C. .13; Mn. .30; Ni. 8.0; Cr. 18.0; MoS_2 .50	7.89			95,000 / 35	152		High resistance to food acids, salts, alkalis, cleansers, sterilizers, and other causes		Food equipment and accessories	fr., p., w.	B, C, CR, FR, HR, S, R, P
Calmar 18-8	Warman Steel Casting Co. Los Angeles, Calif.	Cr. 17-21; Ni. 7-9	7.85	2550-2600	.055 cal. per cm.³ per sec. per deg. C.	75,000 cast / 55 cast	140	Yes	High resistance to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment	br., c., p., r., s., w.	C
Carpenter Stainless No. 1	Carpenter Steel Co. Reading, Pa.	C. .10; Cr. 12.00-14.00	7.779	2525-2725	0.096 c.g.s. units	70,000-190,000 B / 16-30 B	140-187		Resistant-Manufacturer prefers to make definite recommendations only to meet specific problems		Parts of machines, accessories	b., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Carpenter Stainless No. 2	Carpenter Steel Co. Reading, Pa.	C. .30; Cr. 12.0-14.0	7.750	2500-2700		260,000 B (hardened) / 32 B	512		Resistant-Manufacturer prefers to make definite recommendations only to meet specific problems		Parts of machines, accessories	b., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R

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Carpenter Stainless No. 3	Carpenter Steel Co. Reading, Pa.	C. .30; Cr.							Resistant-Manufacturer prefers to make definite		Particularly	b., c., d.,	B, C, CR,

Carpenter Stainless No. 2	Carpenter Steel Co. Reading, Pa.	C. .30; Cr. 12.0-14.0	7.750	2500-2700		260,000 B (hardened)	32 B	512		turer prefers to make definite recommendations only to meet specific problems		Parts of machines, accessories	b., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Carpenter Stainless No. 3	Carpenter Steel Co. Reading, Pa.	C. .30; Cr. 20.00; Cu. 1.0	7.683	2500-2678		100,000 B	22 B	196		Resistant-Manufacturer prefers to make definite recommendations only to meet specific problems		Particularly for high temperature application	b., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Carpenter Stainless No. 4	Carpenter Steel Co. Reading, Pa.	C. .10; Cr. 18.00; Ni. 9.00	7.86	2650		88,000 B	63 B	140		Resistant-Manufacturer prefers to make definite recommendations only to meet specific problems		Woven wire screens, stampings, other machine parts	b., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Carpenter Stainless No. 5	Carpenter Steel Co. Reading, Pa.	C. .10; Cr. 14.00; S. .30	7.778	2525-2725		85,000-164,000 B	11-25 B	187-331		Resistant-Manufacturer prefers to make definite recommendations only to meet specific problems		Machined parts of equipment	b., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Carpenter Stainless No. 6	Carpenter Steel Co. Reading, Pa.	C. .10; Cr. 16.0-18.0	7.7043	2650		80,000 B	25 B	175		Resistant-Manufacturer prefers to make definite recommendations only to meet specific problems		Stampings, moldings, etc.	b., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Carpenter Stainless No. 8	Carpenter Steel Co. Reading, Pa.	C. .10; Cr. 18.0; Ni. 9.0; Se. .25	7.714	2650		90,000 B	50 B	170		Resistant-Manufacturer prefers to make definite recommendations only to meet specific problems		Machined parts of equipment requiring high corrosion resistance	b., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Duraloy A	The Duraloy Co. Pittsburgh, Pa.	C. .30 (castings) Cr. 27.0-30.0; C. .25 (rolled)	7.6	2650-2700	½ that of wrought iron	75,000-80,000 (rolled) 40,000-50,000 cast	20-30 (rolled) 1.0 cast	180 (rolled) 220 cast	Fair, but not recommended by maker	Resistant to food acids, alkalis, cleansers, sterilizers, and other causes	Practically none	Machine parts and accessories	c., d., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Duraloy B	The Duraloy Co. Pittsburgh, Pa.	C. .30 (castings) C. .10 (rolled) Cr. 16-18	7.6	2600-2650	½ that of wrought iron	75,000-85,000 (rolled) 80,000-90,000 cast	30-40 (rolled) 10-20 cast	170 (rolled) 175 cast	Greater than ordinary steel	Similar to, but less than Duraloy A (see above)	Practically none	Machine parts and accessories	c., d., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Duraloy C	The Duraloy Co. Pittsburgh, Pa.	C. .10; Cr. 12-14	7.6	2600-2650	½ that of wrought iron	70,000-85,000 (rolled)	35 (rolled)	160	No	Similar to, but less than Duraloy A (see above)	Practically none	Machine parts and accessories	d., dd., f., fr., p., r., s., w.	B, CR, D, FR, HR, S, T, R
Duraloy N	The Duraloy Co. Pittsburgh, Pa.	C. .25 (rolled); C. .15 or up (cast); Cr. 20-28; Ni. 10-14	7.8	2550-2600	½ that of wrought iron	85,000-100,000 (rolled) 70,000-85,000 cast	50-60 (rolled) 10-15 cast	165 (rolled) 220 cast	No	Resistant to food acids, alkalis, cleansers, sterilizers, and other causes	Practically none	For high temperature applications, primarily	c., d., dd., f., fr., p., r., s., w.	B, C, CR D, FR, HR, S, T, R
Duraloy 18-8	The Duraloy Co. Pittsburgh, Pa.	C. (rolled); .07 or up; C. (cast); .15 or up; Cr. 17-20; Ni. 7-10	7.8	2600-2650	½ that of wrought iron	85,000-100,000 (rolled) 70,000-85,000 cast	60-70 (rolled) 25-35 cast	140 (rolled) 180 cast	No	Resistant to food acids, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories. Structural details	c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Durco KA2S and KA2S Mo	The Duriron Co. Dayton, Ohio	Cr. 18.00; Ni. 8.00	7.89	2650	.05 e.g.s. units	80,000-95,000 cast	40-48 cast	125-140	Fair	Excellent resistance to food acids, alkalis, salts, cleansers, sterilizers and other causes	Practically none	Food equipment and accessories. Structural details	c., fr., w.	B, C
Durimet	The Duriron Co. Dayton, Ohio	C. .07 max.; Cr. 18.00; Ni. 22.00; also Mo. and Si.	7.77	2650	.05 e.g.s. units	68,000-72,000 cast	40-45 cast	130	Fair	Excellent resistance to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	c., fr., w.	B, C
Duriron	The Duriron Co. Dayton, Ohio	Si. 14.5	440 lb. per cu.ft.	2300	12.5 per cent of silver	16,000 cast		50 sclero-scope hardness	Yes	Excellent resistance to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	c., w.	C

FERROUS ALLOYS

Recommended by Manufacturers for Use in Food Plants

Product Trade or Common Name	Name of Manufacturer Supplying Data	Composition by Per Cent	Specific Gravity or Weight	Melting Point Degree F.	Thermal Conductivity	Tensile Strength lb. per sq.in.	Elongation % in 2 in.	Brinell Hardness	Resistance to Abrasion	Resistance to Corrosion	Solubility in Food Ingredients	General Applications	Possible Methods of Fabrication*	Forms in Which Available**
						Form for which these properties are recorded indicated by letters referring to key at end of table								
Duro-Gloss C 1	Jessop Steel Co. Washington, Pa.	C. .10 max.; Cr. 13.0	7.65	2720	.053 c.g.s. units	100,000 (annealed)	20-30	202-212	Fair	Resistant to food acids, salts, alkalis, cleanse.s, sterilizers and other causes	Practically none	Food equipment and accessories	b., br., d., dd., f., fr., p., r., s., w.	B, CR, D, FR, HR, S, R
Duro-Gloss C 2	Jessop Steel Co. Washington, Pa.	C. .10 max.; Cr. 15-18	7.63	2700	.08 c.g.s. units	65,000-80,000 (annealed)	35-25	150-160	Fair	Resistant to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	b., br., d., dd., f., fr., p., r., s., w.	B, CR, D, FR, HR, S, R
Enduro 18-8	Republic Steel Corp. Youngstown, Ohio	C. .05-.15; Cr. 17-19; Ni. 7-9; Si. .75; Mn. .60; S. .03; P. .03	7.92	2560	.035-.06 c.g.s. units	85,000 S & B	55 S & B	135-165 Annealed	Yes	Resistant to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories. Structural details	b., c., d., dd., f., fr., p., r., s., w.	B, CR, D, FR, HR, S, T, R, Strip
Hi-Gloss 164 Mo. Stainless	Jessop Steel Co. Washington, Pa.	C. .10; Cr. 18.; Ni. 8; Mo. 3	7.88		.052 c.g.s. units	90,000-100,000 (annealed)	60-50	140-153	Fair	Resistant to food acids, salts, alkalis. cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	b., br., d., dd., f., fr., p., r., s., w.	B, CR, D, FR, HR, S, R
Hi-Gloss Stainless	Jessop Steel Co. Washington, Pa.	C. .10 max.; Cr. 18; Ni. 8	7.86		.052 c.g.s. units	80,000-90,000 (annealed)	60-55	135-145	Fair	Resistant to food acids, salts, alkalis. cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories. Structural details	b., br., d., dd., f., fr., p., r., s., w.	B, CR, D, FR, HR, S, R
Ingaclad Stainless Clad Steel	Ingersoll Steel & Disc. Co. Chicago, Ill.	20% layer of 18-8 stainless. Bonded to steel	7.9	2650 (stainless)	.069 c.g.s. units	62,000-70,000	48	163 (stainless)		Resistant (stainless surface) to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment	b., br., d., dd., f., p., r., s., w.	HR, CR S, P, Strip
Lebanon Circle L No. 12	Lebanon Steel Foundry Lebanon, Pa.	C. .12 max.; Si. 1.0 max.; Sn. .05; P. .05 max.; Mn. .25-.75; Cr. 11.5-14.0	7.78	2600-2650	.096 c.g.s. units	80,000-100,000 cast	20-28 cast	170-215	Fair	Resistant to mild corrosion involved with certain food conditions	Practically none in most food materials	Food equipment	c., p., s., w.	C
Lebanon Circle L No. 11	Lebanon Steel Foundry Lebanon, Pa.	C. .30 max.; S. .05 max.; P. .05 max.; Ni. 1.0 max.; Cr. 17-21	7.60	2600-2650	0.096 c.g.s. units	85,000-105,000 cast	5-10 cast	180-230	Fair	Very resistant to most food acids, ingredients; but not so resistant to cleansers, etc., as 22, 22-M, 23, 23-M	Practically none	Food equipment	c., p.	C
Lebanon Circle L No. 11-.75C	Lebanon Steel Foundry Lebanon, Pa.	C. .70-1.0; S. .05; P. .05; Ni. 1.0; Cr. 17-21	7.55	2575-2625	.096 c.g.s. units	Depends on hardness needed for service		250-525	Very resistant	Same as Circle L No. 11	Practically none	Food equipment	c., p.	C
Lebanon Circle L No. 23	Lebanon Steel Foundry Lebanon, Pa.	C. .20 max.; S. .05 max.; P. .05 max.; Ni 8-10; Cr. 18-21	7.80	2550-2600	.063 c.g.s. units	75,000-85,000 cast	40-60 cast	130-160	Fair	Very resistant to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	c., p., s.	C
Lebanon Circle L No. 23-M	Lebanon Steel Foundry Lebanon, Pa.	C. .20 max.; S. .05 max.; P. .17 max.; Se. .20-.35; Cr. 18-21; Ni. 8-10	7.80	2550-2600	.063 c.g.s. units	75,000-85,000 cast	30-50 cast	130-160	Fair	Very resistant to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	c., p., s., free machining	C
Lebanon Circle L No. 22	Lebanon Steel Foundry Lebanon, Pa.	C. .07 max.; S. .05 max.; P. .05 max.; Ni. 8-10; Cr. 18-21	7.80	2575-2625	.063 c.g.s. units	70,000-80,000 cast	40-60 cast	125-150	Fair	Very resistant to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	c., p., s., w.	C
Lebanon Circle L No. 22-M	Lebanon Steel Foundry Lebanon, Pa.	C. .07 max.; S. .05 max.; P. .17 max.; Se. .20-.35; Ni. 8-10; Cr. 18-21	7.80	2575-2625	.063 c.g.s. units	70,000-80,000 cast	30-50 cast	125-150	Fair	Very resistant to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	c., p., s., w., free machining	C
Lebanon	Lebanon Steel	C. .30 max.; S.												

Lebanon Circle L No. 22	Lebanon Steel Foundry Lebanon, Pa.	.05 max.; P. .05 max.; Ni. 8-10; Cr. 18-21	7.80	2575-2625	c.g.s. units	80,000 cast	40-60 cast	125-150						

Lebanon Circle L No. 22-M	Lebanon Steel Foundry Lebanon, Pa.	C. .07 max.; S. .05 max.; P. .17 max.; Se. .20-.35; Ni. 8-10; Cr. 18-21	7.80	2575-2625	.063 c.g.s. units	70,000 80,000 cast	30-50 cast	125-150	Fair	Very resistant to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	c., p., s., w., free machining	C
Lebanon Circle L No. 31	Lebanon Steel Foundry Lebanon, Pa.	C. .30 max.; S. .05 max.; P. .05 max.; Ni. 10-12; Cr. 26-30	7.90	2625-2675	.030 c.g.s. units	85,000-100,000 cast	20-30 cast	150-200	Fair	Very resistant to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	c., p., s., w.	C
Milwaloy No. 26	Milwaukee Steel Foundry Co. Milwaukee, Wis.	Cr. 18-20; Ni. 8-9	7.85	2550	.058 c.g.s. units	74,000 cast	45 cast	140	Fair	Resistant to corrosion by food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	b., c., p., r., s., w.	C
No. 48 Alloy	Michiana Products Corp. Michigan City, Ind.	Cr. 28; Ni. 8	7.88	2450	0.30 c.g.s. units	65,000 cast	1 cast	200-220			Practically none		c.	C
No. 100 Alloy	Michiana Products Corp. Michigan City, Ind.	Cr. 25; Ni. 12	7.87	2400-2475	.042 c.g.s. units	65,000 cast	3.5 cast						b., c., d., f., p., r., s., w.	B, C, D, R, S, HR
Pioneer Metal	Pioneer Alloy Products Co. Cleveland, Ohio	65 per cent Ni., Cr., Mo.	7.833	2750		74,000	42	140	Yes	Resistant to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	c., free machining	C
Rezistal 12	Crucible Steel Co. of America New York, N. Y.	C. .20; Cr. 12-15	7.75		.096 c.g.s. units	87,000-190,000 B-S-P	31.2 B-S-P	170-363	Yes	Excellent resistance to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	b., br., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Rezistal 17	Crucible Steel Co. of America New York, N. Y.	C. .12 max.; Cr. 15-16	7.72		.072 c.g.s. units	75,000-85,000 B-S-P	30-40 B-S-P	150-190	Yes	Better than Rezistal 12	Practically none	Food equipment and accessories	b., br., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Rezistal KA-2	Crucible Steel Co. of America New York, N. Y.	C. .08-.20; Cr. 17-19; Ni. 7-9	7.94	2550	.052 c.g.s. units	85,000-95,000 B-S-P	55-60 B-S-P	130-170	Yes	Better than Rezistal 12	Practically none	Food equipment and accessories. Structural details	b., br., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Rezistal KA-2S Mo	Crucible Steel Co. of America New York, N. Y.	C. .07 max.; Mo. 2-4; Ni. 7-11; Cr. 16-20	7.91		.052 c.g.s. units	90,000-100,000 B-S-P	50-60 B-S-P	170-200	Yes	Possesses maximum resistance to food acids, salts, alkalis, cleansers sterilizers, and other causes	Practically none	Food equipment and accessories	b., br., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Rezistal KA-2S	Crucible Steel Co. of America New York, N. Y.	C. .07 max.; Cr. 17-19; Ni. 7-9	7.94	2550	.052 c.g.s. units	85,000-95,000 B-S-P	55-60 B-S-P	130-170	Yes	Better than Rezistal 12	Practically none	Food equipment and accessories	b., br., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
S-17	Cooper Alloy Foundry Co. Elizabeth, N. J.	Cr. 18; Ni. 8; C. .20 max.								Resistant to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	c.	C
Silcrome KA-2 and KA-2S	Ludlum Steel Co. Watervliet, N. Y.	Cr. 17-19; Ni. 7-9	7.86	2560	.053 c.g.s. units	85,000-95,000 B, S	50-60 B, S	150-200	Yes	Resistant to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories. Structural details	b., c., d., dd., f., fr., p., r., s., w.	B, CR, D, FR, HR, S, R
Silcrome RA	Ludlum Steel Co. Watervliet, N. Y.	Cr. 16; Cu. 1; Si. .75; C. .08	7.67	2750	.080 c.g.s. units	70,000-80,000 B, S	20-30 B, S	170-200	Yes	Resistant to food acids, salts, alkalis, cleansers, sterilizers	Practically none	Food equipment and accessories	b., d., dd., f., fr., p., r., s., w.	B, CR, D, FR, HR, S, R
Silcrome 12	Ludlum Steel Co. Watervliet, N. Y.	C. .12 max.; Cr. 12-15	7.77	2700	.096 c.g.s. units	100,000-120,000 HT	18-22 HT	200-225	Yes	Resistant to food acids, salts, alkalis, cleansers, sterilizers	Practically none	Food equipment and accessories	c., d., fr., p.	B, CR, D, FR, HR
Sta-Gloss A	Jessop Steel Co. Washington, Pa.	C. .35; Cr. 13.5	7.75		.050 c.g.s. units	80,000-230,000 HT	28-1 HT	196-500 HT	Fair	Resistant to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	b., br., d., f., fr., p., r., s., w.	B, CR, D, FR, HR, S, R

FERROUS ALLOYS

Recommended by Manufacturers for Use in Food Plants

Product Trade or Common Name	Name of Manufacturer Supplying Data	Composition by Per Cent	Specific Gravity or Weight	Melting Point Degree F.	Thermal Conductivity	Tensile Strength lb. per sq.in.	Elongation % in 2 in.	Brinell Hardness	Resistance to Abrasion	Resistance to Corrosion	Solubility in Food Ingredients	General Applications	Possible Methods of Fabrication*	Forms in Which Available**
						Form for which these properties are recorded indicated by letters referring to key at end of table								
Stainless Steel	American Stainless Steel Co. Pittsburgh, Pa.	Cr. 8-60; C. .12-1.00		2750	.0334 c.g.s. units	100,000-240,000 HT	4-27 HT	185-500 HT	Yes	Resistant to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	b., c., d., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R, P
Stainless Iron	American Stainless Steel Co. Pittsburgh, Pa.	Cr. 8-60; C. .10-.12	7.77	2725	.046 c.g.s. units	85,000-185,000 HT	17.5-33 HT	165-395 HT	Yes	Resistant to food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Food equipment and accessories	b., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R, P
Stainless "A"	Vanadium-Alloy Steel Co. Latrobe, Pa. Colonial Steel Co. Pittsburgh, Pa.	C. .35; Cr. 13.5	7.74		.052 c.g.s. units	252,000 B-H 143,000 B-ST	4 B-H 13.5 B-ST	512 B-H 302 B-ST	Fair					B, HR, D
Stainless "I"	Vanadium-Alloy Steel Co. Latrobe, Pa. Colonial Steel Co. Pittsburgh, Pa.	C. .12; Cr. 13.25	7.76		.050 c.g.s. units	178,000 B-H 96,000 B-ST	16 B-H 27 B-ST	364 B-H 196 B-ST						B, HR, D
Stainless "N"	Vanadium-Alloy Steel Co. Latrobe, Pa. Colonial Steel Co. Pittsburgh, Pa.	C. .15 max.; Cr. 18.25; Ni. 9.0	7.93		.035 c.g.s. units	92,000 B	58 B	155						B, HR, D
Stainless C-2	Vanadium-Alloy Steel Co. Latrobe, Pa. Colonial Steel Co. Pittsburgh, Pa.	C. .12 max.; Cr. 17				75,000 B	33 B	170						B, HR, D
Stainless 410	Vanadium-Alloy Steel Co. Latrobe, Pa. Colonial Steel Co. Pittsburgh, Pa.	C. .12 max.; Cr. 13.50; Ni. .80	7.76		Annealed-$\frac{1}{3}$ of iron Hard-$\frac{1}{4}$ of iron	128,000 B-H	20 B-H							B, HR, D
Tisco 101	Taylor Wharton Iron & Steel Co. High Bridge, N. J.	C. .16 max.; Mn. 1 max.; Si. 2 max.; P .03; S. .03; Cr. 16.5-20; Ni. 7-10.5	7.86	2550-2600	.05 c.g.s. units	70,000-75,000 cast	50-60 cast	130-150	Yes	Resistant to corrosion by food acids, alkalis, salts, cleansers, sterilizers	Practically none	Food equipment and accessories	c., p., r., w.	C
Tisco 102	Taylor Wharton Iron & Steel Co. High Bridge, N. J.	C. .07 max.; Mn. 1 max.; Si. 2 max.; P .03; S. .03; Cr. 16.5-20; Ni. 7-10.5	7.86	2550-2600	.05 c.g.s. units	65,000-70,000 cast	50-60 cast	130-150		Resistant to corrosion by food acids, alkalis, salts, cleansers, sterilizers	Practically none	Food equipment and accessories	c., p., r., w.	C
Tisco 131	Taylor Wharton Iron & Steel Co. High Bridge, N. J.	C. .10 max.; Mn. .40-.60; Si. 2 max.; P. .05; S. .05; Cr. 16-18	7.6	2600-2700	.063 c.g.s. units	75,000-100,000 cast	5-12 cast	190-210	Yes	Resistant to corrosion by food acids, alkalis, salts, cleansers, sterilizers	Practically none	Food equipment and accessories	c., p., r., w.	C
USS 17	National Tube Co. Pittsburgh, Pa.	C. .10 max.; Si. .50 max.; Mn. 0.50 max.; Cr. 16-18	.273 lb. per cu.in.	2710-2750	169 B.t.u. per sq.ft. per hr. per deg. F. per in.	75,000 (annealed)	27 (annealed)	175	Yes	Resistant to most of the more common food acids, salts, alkalis, cleansers, sterilizers	Good, but less insoluble than USS 18-8	Food equipment and accessories	f., p., r., s., w., spinning	T Pipe
USS 18-8	National Tube Co. Pittsburgh, Pa.	C. .15; Si. .75; Mn. .50 max.; Cr. 17-20; Ni.	.286 lb. per cu.in.	2550-2590	113 B.t.u. per sq.ft. per hr.	80,000-95,000	50-60 (annealed)			Resistant under customary	Very slight except in		f., p., r.,	

USS 17	National Tube Co. Pittsburgh, Pa.	C. .10 max.; Si. .50 max.; Mn. 0.50 max.; Cr. 16-18	.273 lb. per cu.in.	2710-2750	per sq.ft. per hr. per deg. F. per in.	75,000 (annealed)	27 (annealed)	175		food acids, salts, alkalis, cleansers, sterilizers	USS 18-8	cessories		
USS 18-8	National Tube Co. Pittsburgh, Pa.	C. .15; Si. .75; Mn. .50 max.; Cr. 17-20; Ni. 8-12	.286 lb. per cu.in.	2550-2590	113 B.t.u. per sq.ft. per hr. per deg. F. per in.	80,000-95,000 (annealed)	50-60 (annealed)	135-185	Yes	Resistant under customary processing conditions to food acids, salts, alkalis, cleansers, sterilizers	Very slight except in strong hot solutions of citric, tartaric acids, etc.	Food equipment and accessories	f., p., r., s., w., b., spinning., bending, expanding	T Pipe
USS Stabilized 18-8	National Tube Co. Pittsburgh, Pa.	C. .10 max.; Si. .50 max.; Mn. .50 max.; Cr. 16-18	.285 lb. per cu.in.	2550-2590	112 B.t.u. per sq.ft. per hr. per deg. F. per in.	80,000-95,000 (stabilized)	50-55 (stabilized)	135-185	Yes	Same as USS 18-8	Same as USS 18-8	Food equipment and accessories	f., p., r., s., w., spinning	T Pipe
USS 17	Carnegie-Illinois Steel Corp. Pittsburgh, Pa.	C. .10 max.; Si. .50 max.; Mn. .50 max.; Cr. 16-18	.273 lb. per cu.in.	2710-2750	169 B.t.u. per sq.ft. per hr. per deg. F. per in.	75,000 (annealed)	27 (annealed)	175	Yes	Resistant to most of the more common food acids, salts, alkalis, cleansers, sterilizers	Good, but less insoluble than USS 18-8	Food equipment and accessories	dd., fr., p., r., s., w.	B, P, Special sections
USS 18-8	Carnegie-Illinois Steel Corp. Pittsburgh, Pa.	C. .15; Si. .75; Mn. .50 max.; Ni. 8-12; Cr. 17-20	.286 lb. per cu.in.	2550-2590	113 B.t.u. per sq.ft. per hr. per deg. F. per in.	80,000-95,000 (annealed)	55-60 (annealed)	135-185	Yes	Resistant under customary processing conditions to food acids, salts, alkalis, cleansers, sterilizers	Very slight except in strong hot solutions of citric, tartaric acids, etc.	Food equipment and accessories	b., fr., dd., p., r., s., w., spinning	B, P, Special sections
USS Stabilized 18-8	Carnegie-Illinois Steel Corp. Pittsburgh, Pa.	C. .10 max.; Si. .50 max.; Mn. .50 max.; Cr. 16-18	.285 lb. per cu.in.	2550-2590	112 B.t.u. per sq.ft. per hr. per deg. F. per in.	80,000-95,000 (stabilized)	50-55 (stabilized)	135-185	Yes	Same as USS 18-8	Same as USS 18-8	Food equipment and accessories	dd., fr., p., r., s., w.	B, P, Special sections
USS 17	American Steel & Wire Co. Chicago, Ill.	C. .10 max.; Si. .50 max.; Mn. .50 max.; Cr. 16-18	.273 lb. per cu.in.	2710-2750	169 B.t.u. per sq.ft. per hr. per deg. F. per in.	75,000 (annealed)	27 (annealed)	175	Yes	Resistant to most of the more common food acids, salts, alkalis, cleansers, sterilizers	Good, but less insoluble than USS 18-8	Food equipment and accessories	dd., p., s., w.	CR Strip
USS 18-8	American Steel & Wire Co. Chicago, Ill.	C. .15; Si. .75; Mn. .50 max.; Ni. 8-12; Cr. 17-20	.286 lb. per cu.in.	2550-2590	113 B.t.u. per sq.ft. per hr. per deg. F. per in.	80,000-95,000 (annealed)	55-60 (annealed)	135-185	Yes	Resistant under customary processing conditions to food acids, alkalis, salts, cleansers, sterilizers	Very slight except in strong hot solutions of citric, tartaric acids, etc.	Food equipment and accessories	b., dd., s., w.	CR Strip
USS Stabilized 18-8	American Steel & Wire Co. Chicago, Ill.	C. .10 max.; Si. .50 max.; Mn. .50 max.; Cr. 16-18	.285 lb. per cu.in.	2550-2590	112 B.t.u. per sq.ft. per hr. per deg. F. per in.	80,000-95,000 (stabilized)	50-55 (stabilized)	135-185	Yes	Same as USS 18-8	Same as USS 18-8	Food equipment and accessories	dd., p., s., w.	CR Strip
USS 17	American Sheet & Tin Plate Co. Pittsburgh, Pa.	C. .10 max.; Si. .50 max.; Mn. .50 max.; Cr. 16-18	.273 lb. per cu.in.	2710-2750	169 B.t.u. per sq.ft. per hr. per deg. F. per in.	75,000 (annealed)	27 (annealed)	175	Yes	Resistant to most of the more common food acids, salts, alkalis, cleansers, sterilizers	Good but less insoluble than USS 18-8	Food equipment and accessories	dd., p., r., s., w.	S, P
USS 18-8	American Sheet & Tin Plate Co. Pittsburgh, Pa.	C. .15; Si. .75; Mn. .50 max.; Ni. 8-12; Cr. 17-20	.286 lb. per cu.in.	2550-2590	113 B.t.u. per sq.ft. per hr. per deg. F. per in.	80,000-95,000 (annealed)	55-60 (annealed)	135-185	Yes	Resistant under customary processing conditions to food acids, salts, alkalis, cleansers, sterilizers	Very slight except in strong hot solutions of citric, tartaric acids, etc.	Food equipment and accessories	b., dd., r., s., w., spinning	S, P
USS Stabilized 18-8	American Sheet & Tin Plate Co. Pittsbrugh, Pa.	C. .10 max.; Si. .50 max.; Mn. .50 max.; Cr. 16-18	.285 lb. per cu. in.	2550-2590	112 B.t.u. per sq.ft. per hr. per deg. F. per in.	80,000-95,000 (stabilized)	50-55 (stabilized)	135-185	Yes	Same as USS 18-8	Same as USS 18-8	Food equipment and accessories	dd., p., r., s., w.	S, P
Zorite	Michiana Products Corp., Michigan City, Ind.	Cr. 15; Ni. 37	7.90	2350-2430	.04 c.g.s. units	55,000 cast	5 cast	180					d., f., r., w.	B, C, HR, S

*Methods of Fabrication: b. = brazing; br. = burning; c. = casting; d. = drawing; f. = flanging; fr. = forging; r. = riveting; s. = soldering; w. = welding; dd. = deep drawing; p. = polishing; ex. = extruding.

**Forms Available: B = Bar; C = Casting; CR = Cold Rolled; D = Drawn; FR = Forging; HR = Hot Rolled; S = Sheets; T = Tubing; R = Rods; P = Plate.

†Key to Forms Tested: HT = Heat Treated; Cast = As Cast; H = Hard Temper; ST = Soft Temper; CDR = Cold Drawn Rod; B = Bar; F. = Forged; C = Cast Bar; T = Tubes; S = Sheet; P = Plate.

Note: Other alloys similar to those listed are available; but the manufacturers did not contribute data to this table.

NON-FERROUS ALLOYS

Recommended by Manufacturers for Use in the Food Industries

Product Trade or Common Name	Name of Manufacturer Supplying Data	Composition By Per Cent	Specific Gravity or Weight	Melting Point Degrees F.	Thermal Conductivity	Tensile Strength lb./sq. in.	Elongation % in 2 in.	Brinell Hardness	Resistance to Abrasion	Resistance to Corrosion	Solubility in Food Ingredients	General Applications	Possible Methods of Fabrication *	Forms in Which Available **
						Form for which these properties are recorded indicated by letters referring to Key at end of Table								
Admiralty	The American Brass Co., Waterbury, Conn.	Cu 70; Zn 29; Sn 1	.308 lb per cu.in.	1715	.263 c.g.s. units	55,000 T-ST	60 T-ST					Tubes	b., c., d., dd., f., fr., p., r., s., w.	CR, D, S, T
Adnic	Scovill Mfg. Co., Waterbury, Conn.	Cu 70; Ni 29; Sn 1	.321 lb. per cu.in.	2201		60,000-100,000 SP	40-2 SP	75–220	Good	Excellent resistance to food acids, salts, alkalis, cleansers, sterilizers, electrolysis, chlorine, or other	Practically none		b., br., c., d., dd., f., fr., p., r., s., w.	CR, D, FR, S, T, R
Aluminum-Manganese Alloy, 3 S	Aluminum Co. of America, Pittsburgh, Pa.	Al; Mn 1.25	.0986 lb per cu.in	1198–1211	.36 c.g.s. units	29,000 S 16,000 after annealing to 3S-O	4 S 30 after annealing to 3S-O	55 (3 S-H) 28 (3 S-O)	Yes	Attacked by strong alkalis, chlorine. Resists food acids, salts, alkalis, and cleansers containing inhibitors	Practically none		d., dd., f., fr., p., r., s., w., ex.	B, CR, D, FR, HR, S, T, R
Aluminum-Magnesium-Manganese Alloy 4S	Aluminum Co. of America, Pittsburgh, Pa.	Al; Mn 1.25; Mg 1.00	.098 lb. per cu.in.	1166–1207	.38 c.g.s. units	42,000 S (4S-H) 26,000 S(4S-O)	3 S (4S-H) 20 S (4S-O)	80 (4 S-H) 45 (4 S-O)		Same as Aluminum-Manganese Alloy 3 S	Practically none		d., f., fr., p., r., s., w., ex.	B, CR, D, FR, HR, S, T, R
Ambrac 850	The American Brass Co., Waterbury, Conn.	Cu 75; Zn 5; Ni 20	.32 lb. per cu.in.	2102	.092 c.g.s. units	S 85,000 H 50 000 S	5 S—Hard 25 S—Soft	160 Hard 58 Soft					b., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Ampco No. 18	Ampco Metal, Inc., Milwaukee, Wis.	Cu 84.6; Al 11.44; Fe 3.70	.27 lb. per cu.in.	1825	.182 c.g.s. units	77,000–85,000 Cast	10–14 Cast	167–179	Yes	Resistant to food acids, salts, alkalis, cleansers, chlorine, sterilizers, electrolysis, other	Not definitely known	Valves, gears, bearings, machine parts requiring fatigue resistance.	b., c., fr., p., r., s., w.	B, C, FR, HR, S, R
Amsco Alloy F5	American Manganese Steel Co., Chicago Heights, Ill.	Ni 65; Cr 18	8.0	2550	.033 c.g.s. units	50,000–70,000 Cast	1–5 Cast	180–200		High resistance to food acids, salts, alkalis, cleansers, chlorine sterilizers, electrolysis, or other	Low		c., w.	C
Cataract Metal	Niagara Falls Smelting & Refining Corp.	Cu; Ni	8.69–8.98	2250-2350		45,000–55,000		16–18 Scleroscope		Resists food acids, alkalis, salts, cleansers, sterilizers	Practically none	Food equipment and accessories	c., p.	C
Dowmetal	The Dow Chemical Co., Midland, Mich.	Mg 90–95; Al, Mn, Zn	1.8	1100–1160	0.17–0.23 c.g.s. units	33,000–38,000 Cast HT	9–13 Cast HT	50–53		Resists alkalis, but not salts or acids			fr., r., s., w., c.	B, C, CR, FR, HR, S, T, R
18% Nickel Silver	Scovill Mfg. Co., Waterbury, Conn.	Cu 64; Ni 18; Zn 18	.316 lb. per cu.in.	2012	.079 c.g.s. units	54,000–100,000 SP	50–1 SP	65–210	Fair	Resists food acids, salts, alkalis, cleansers, chlorine, sterilizers, electrolysis, and other causes	Slight		b., br., c., d., dd., f., fr., p., r., s., w.	CR, D, S, R
18% Nickel Silver	The American Brass Co., Waterbury Conn.	Cu 65; Ni 18; Zn 17	.316 lb. per cu.in.	2030	.080 c.g.s. units	58,000–90,000 S	40–3 S	70–170					b., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Everbrite	American Manganese Bronze Co., Holmesburg, Philadelphia Pa.	Cu 62; Ni 31; Fe 6				75,000 Cast	14 Cast	175	Good	Resistant to food acids as organic acids, citric acid, some concentrations of lactic acid			c., p.	C
Everdur 1010	The American Brass Co., Waterbury, Conn.	Cu 96; Si 3; Mn 1	.308 lb. per cu.in.	1866	.078 c.g.s. units	55,000–113,000 S	5–48 S	70–200					b., c., d., dd., f., fr., p., r., s., w	B, C, CR, D, FR, HR, S, T, R
52 S-H and 52 S-O	Aluminum Co. of America, Pittsburgh, Pa.	Mn 2.5; Cr 0.25; Al	2.67	1112–1202	.32 c.g.s. units	S 39,000-(52 S-H) 31,000-(52 S-O)	7 (52 S-H) 25 (52S-O)	85 (52 S-H) 45 (52 S-O)		Attacked by strong alkalis, chlorine. Resists food acids, salts, alkalis, and cleansers containing inhibitors	Practically none		d., f., fr., p., r., s., w., ex.	B, CR, D, FR, HR, S, T, R
53 S-W and 53 S-O	Aluminum Co. of America, Pittsburgh, Pa.	Si .70; Mg 1.25 Cr. 25; Al	2.69	1083–1200	.38 c.g.s. units	28,000 (53 S-W) 19,000 (53 S-O)	22 (53 S-W) 25 (53 S-O)	65 (53 S-W) 26 (53 S-O)		Attacked by strong alkalis, chlorine. Resists food acids, salts, alkalis, and cleansers containing inhibitors	Practically none		d., f., fr., p., r., s., w., ex	B, CR, D, FR, HR, S, T, R
Fire Armor	Michiana Products Corp., Michigan City,	Ni 65; Cr 20	8.06	2375–2450	.034 c.g.s. units	60,000 Cast								

Fire Armor	Michiana Products Corp., Michigan City, Ind.	Ni 65; Cr 20	8.06	2375–2450	.034 c.g.s. units	60,000 Cast	1.2 Cast	190					c., w.	C
Fire Armor B	Michiana Products Corp., Michigan City, Ind.	Ni 60; Cr 12	8.0	2380–2450	.033 c.g.s. units	58,000 Cast	3 Cast						c., d., f., r., w.	C, S, HR(bars and sheets)
Illium G	Burgess-Parr Co., Freeport, Ill.	Ni 56; Cr 24; Cu 8; Fe 4; Mo 4; W 2; Mn 1.25; Si .75	8.3	2500		60,000		170–200	Good	High resistance to food acids, salts, alkalis, cleansers, sterilizers, electrolysis, or other causes	Practically none		c., p., s., w.	C
Inconel	International Nickel Co., Inc., New York, N. Y.	Ni 80; Cr 14 Balance mostly Fe	8.55	1388	3.5 per cent of copper	100,000–115,000 CDR 80,000– 95,000 (annealed sheet)	20–30 CDR 45–55 (annealed sheet)	240–260 CDR 120–130 (annealed)	Good	Resistant to food acids, salts, alkalis, cleansers, chlorine, sterilizers, electrolysis, or other causes			b., br., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Inconel-Clad Steel	Lukens Steel Co. Coatesville, Pa.	Inconel bonded to steel	Varies		Lower than steel				Yes	Inconel surface same as for Inconel			b., d., dd., f., p., r., s., w.	HR Plates
Monel Metal	International Nickel Co., Inc., New York N. Y.	Ni 65-70; Cu 27-32; Fe 2 max.; Mn 1.3 max.; Si 0.75; C 0.25	8.8	1300–1350	6.6 per cent of copper	85,000–125,000 CDR 65,000– 80,000 (annealed sheet)	15–35 CDR 35–50 (annealed sheet)	190-220 CDR 80-105 (annealed)	Very High	High resistance to food acids, salts, alkalis, cleansers, chlorine, sterilizers, electrolysis, or other causes	Practically none	Food equipment and accessories	b., br., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Monel Metal	American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.	Cu 23; Ni 60; Fe 3.5; Al 0.5; Mn 3.5; C 2.0				65,000 Cast	25 Cast	105		Good resistance to vegetable and fruit acids, also lactic acid	Low	Food equipment and accessories	c., p., w.	C
Nickel-Clad Steel	Lukens Steel Co. Coatesville, Pa.	Nickel bonded to steel	Varies		Same as steel	P 55,000 minimum	P 25 in. 8 in.	100–150	Yes	Nickel surface same as pure nickel	Same as pure nickel		b., d., dd., f., p., r., s., w.	HR S Plates
Olympic Bronze	Chase Brass and Copper Co., Waterbury, Conn.	Cu. 96; Si. 3; Zn 1	.31 lb. per cu.in.	1870	.056 B.t.u. per sq.ft. per in. per sec. per deg. F.	S 55,000–110,000	S 60–7	90–185	Yes	Corrosion resistance good. Tendency to contaminate foods under some conditions	Slight		b., br., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR, S, T, R
Red Brass 85	The American Brass Co., Waterbury, Conn.	Cu 85; Zn 15	.316 lb. per cu.in.	1868	.335 c.g.s. units	68,000–42,000 T	6–42 T						b., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, S, T, R
Stellite 1	Haynes Stellite Co., Kokomo, Ind.	Co 50; Cr 30; W 15.5	8.59	2280		40,000 Cast	0.5 Cast	512	Excellent	Resists food acids, salts, alkalis, cleansers, sterilizers, and other causes	Practically none	Welded onto wearing surfaces of grinders or mills. Used in valve parts. For wearing parts	b., w.	Welding rod
Stellite 12	Haynes Stellite Co.	Co 60; Cr 30; W 8	8.40	2300		66,000 Cast		444	Excellent	Same as Stellite 1	Practically none	Same as Stellite 1	b., w.	Welding rod
Super Nickel	The American Brass Co., Waterbury, Conn.	Cu 70; Ni 30	.323 lb. per cu.in.	2237	.069 c.g.s. units	65,000 T	30 T						b., c., d., dd., f., fr., p., r., s., w.	B, C, CR, D, FR, HR S, T, R,
Waukesha Metal	Waukesha Foundry Co., North Chicago, Ill.	Cu. 60; Ni 28; Fe 9; Pb0; Zn 0	8.4	2250		60,000	8	130		Practically inert to food acids, salt, and cleansers			c.	C

*Methods of Fabrication: b. = brazing; br. = burning; c. = casting; d. = drawing; f. = flanging; fr. = forging; r. = riveting; s = soldering; w. = welding; dd. = deep drawing; p. = polishing; ex. = extruding.
**Forms Available: B = Bar; C = Casting; CR = Cold Rolled; D = Drawn; FR = Forging; HR = Hot Rolled; S = Sheets; T = Tubes; R = Rods; P = Plate
Key to Forms Tested: HT = Heat Treated; Cast = As Cast; H = Hard Temper; ST = Soft Temper; CDR = Cold Drawn Rod; B = Bar; C = Cast Bar; S = Sheet; P = Plate; T = Tube; SP = Strip.
Note: Data given is that supplied by maker. Other alloys of similar types are made for which no data was made available.

PLASTIC MATERIALS

Properties of Synthetic Resins and Similar Materials of Types That Have Been Used in the Food Field

Material	Form	Specific Gravity	Softening Point Deg. F.	Thermal Conductivity 10^{-4} cal. per sec. cm. deg. C	Tensile Strength lb. per sq. in.	Elongation per cent	Resistant to Corrosion and Solubility in Food Ingredients	Effect of Water		Effect of Aging	Effect of Light	Effect of Heat	Machining Qualities	Forms Available
								Cold	Hot					
Phenolic Resinoids	Pure Hardened Resinoid	1.2-1.3	.....	3 to 4	8-in. test piece 5,000 to 11,000	.....	Withstands dilute acetic, citric, lactic acids, fatty acids and brine, but not strong cleansing agents	.....	.....	None	Slight by ultra-violet	Withstands 250 deg. F. with some hardening	Good	All forms
	Molded with Wood Flour Filler	1.3-1.4	.....	4 to 6	A.S.T.M. Test 6,000 to 12,000	.....	See above	None	.....	None	Slight by ultra-violet	Withstands 250 deg. F. with some hardening	Good	Molded forms
	Molded with Fabric Filler	1.3-1.4	.....	4 to 6	A.S.T.M. Test 4,500 to 9,000	.....	See above	.....	.....	Improved	Slight by ultra-violet	Withstands 250 deg. F. with some hardening	Fair	Molded forms
	Molded with Asbestos Filler	1.8-2.0	.....	12 to 20	A.S.T.M. Test 5,000 to 10,000	.....	See above	Very Resistant	.....	Improved	Slight by Ultra-violet	Withstands 375 to 475 deg. F.	Fair	Molded Forms
	Laminated with Paper Filler	1.3-1.4	.....	5 to 8	6,000 to 20,000	.....	See above	Slight	More Rapid	Improved	Slight by ultra-violet	Withstands 250 deg. F. with some hardening	Good	Sheets, Tubes and Rods Pressed Forms
	Laminated with Fabric Filler	1.3-1.4	.....	5 to 8	8,000 to 12,000	.....	See above	None	None up to 30 min. boiling	Improved	Slight by ultra-violet	Withstands 250 deg. F. with some Hardening	Good	Sheets, Tubes and Rods Pressed Forms
Urea-Formaldehyde Resinoid	Molding Plastic	1.48 to 1.53	.....	.....	5,000 to 6,400	.....	Resists cold dilute food acids, fatty acids and dilute alkalis	.....	.....	None	None	Slight	Fair	Molded forms
Cellulose Nitrate	Plastic	1.35 to 1.60	160 to 195	3.1 to 5.1	4,000 to 10,000	5 to 30	Resists acetic acid, fatty acids, brine, and hypochlorite solutions	Slight swelling	Slight swelling	None	Become brittle	Decomposed at 100 to 150 deg. C.	Good	Sheets Tubes Rods Miscellaneous
Cellulose Acetate	Plastic	1.27 to 1.31	115 to 160	5.4 to 6.3	5,400	13	Resists fatty acids, brine, and hypochlorite solutions but not acids or alkalis stronger than 0.5 per cent	Slight swelling	Attacked	None	Become brittle	More stable than cellulose nitrate	Good	Sheets Tubes Rods Miscellaneous
	Press Powder	1.30 to 1.63	162 to 300	5.3 to 8.7	1,800 to 3,200	0.2 to 0.5	See above	Attacked	Attacked	None	Become brittle	More stable than cellulose nitrate	Good	Sheets Tubes Rods Miscellaneous
Styrol Resin	Various	1.06 (Uncompounded)	194+	.....	.....	.....	Resists acetic acid and caustic soda	None	None	None	Slight Oxidation	Will soften under high heat	Good	Sheets Tubes Rods

Some Commercially Available Plastic Materials

Trade Name	Manufacturer	Type
Bakelite	Bakelite Corporation, 247 Park Ave., New York N. Y.	Phenolic resinoid
Catalin	American Catalin Corp., 1 Park Ave., New York, N. Y.	Phenolic resinoid cast
Celeron	Continental-Diamond Fibre Co., Newark, Del.	Phenolic resinoid molded
Celluloid	Celluloid Corporation, Newark, N. J.	Cellulose nitrate
Dilecto	Continental-Diamond Fibre Co., Newark, Del.	Phenolic resinoid laminated
Dures	General Plastics, Inc., North Tonawanda, N. Y.	Phenolic resinoid
Durite	Stokes & Smith Co., Philadelphia, Pa.	Phenolic resinoid
Formica	Formica Insulation Co., Cincinnati, Ohio	Phenolic resinoid
Haveg	Haveg Corporation, Newark, Del.	Phenolic resinoid
Indur	Reilly Tar & Chemical Co. Indianapolis, Ind.	Phenolic resinoid
Lamicoid	Mica Insulator Co., Schenectady, N. Y.	Phenolic resinoid
Lumarith	Celluloid Corporation, Newark, N. J.	Cellulose Acetate
Micarta	Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.	Phenolic resinoid
Plastecele	Du Pont Viscoloid Co., Arlington, N. J.	Cellulose Acetate
Plaskon	Toledo Synthetic Products, Inc., Toledo, Ohio	Urea resinoid
Pliolite	Goodyear Tire & Rubber Co., Akron, Ohio	Rubber resinoid
Pyralin	Du Pont Viscoloid Co., Arlington, N. J.	Cellulose nitrate
Pyroflex	Maurice A. Knight, Akron, Ohio	Depolymerized colloidal resin
Resinox	Resinox Corporation 230 Park Ave., New York, N. Y.	Phenolic resinoid

Vinyl Resin	Filled	1.2 to 2.5	160	.....	7,000	.....	Resists acids (acetic, citric, and lactic); fatty acids, brine and cleansing agents	None	Softens	None	.....	Darkens at 150 deg. C.	Good	Sheets Tubes Rods
	Unfilled	1.23	150	.....	9,000	.....	See above	None	Softens	None	.....	Darkens at 150 deg. C.	Good	Sheets Tubes Rods
Resin based on Rubber	Various	1.06 to 1.35	160+	.....	4,500 to 7,000	.....	Resists acetic, citric and lactic acids, brine and cleansing agents	None	None	None	Slight	Becomes Thermo-plastic	Good	Various
Depolymerized colloidal resin	Sheets or Plastics	.....	350 to 630	Low	300 at 70 deg. F.	.....	Resists acids (dilute) salts and alkalis. Imparts no taste or odor to milk	.....	.....	None	.....	Softens	.....	Sheets Bulk

Spauldite	Spaulding Fibre Co., Tonawanda, N. Y.	Phenolic resinoid
Tenite	Tennessee Eastman Corp. Kingsport, Tenn.	Cellulose acetate
Textolite	General Electric Co., Schenectady, N. Y.	Phenolic resinoid
Unyte	Unyte Corporation, 521 Fifth Ave., New York, N. Y.	Urea resinoid
Victron	Naugatuck Chemical Co., 1790 Broadway, New York, N, Y.	Styrol resinoid
Vinylite	Carbide & Carbon Chem., Co., 30 E. 42d St., New York	Vinyl resinoid

COMMON WOODS

Commonly Used for Equipment and Structures in Food Plants

Kind of Wood	Weight per cu. ft. at 12 per cent moisture	Absorption of Food Ingredients* gm. per strip 4 in. x 1 in. x ¼ in.							Per Cent Permanent Expansion, Caused by Food Ingredients							Physical Effects of Food Ingredients**				Color Imparted to Food Ingredients					Taste Imparted to Water
		Water		Dilute Acetic Acid	Salt Brine		Cottonseed Oil		Water		Dilute Acetic Acid	Salt Brine		Cottonseed Oil		Water	Dilute Acetic Acid	Salt Brine 10 per cent	Cotton-seed Oil	Water		Dilute Acetic Acid	Salt Brine 10 per cent	Cotton-seed Oil	
		Cold	Hot	Cold	Cold	Hot	Cold	Hot	Cold	Hot	Cold	Cold	Hot	Cold	Hot					Cold	Hot	Cold	Cold	Hot	
Cypress (Tidewater Red)	32 lb.	3.8	5.4	4.3	1.6	5.7	2.1	4.4	1.0	2.0	3.5	2.5	1.0	0.0	—2.1	None	None	None	None	No.	Yes††	No	Yes	No	No
Douglas Fir	30 lb.	5.1	7.7	3.4	2.6	6.5	1.2	4.4	0.5	0.5	2.5	2.2	1.1	0.0	—2.4	None	None	None	None	No	Yes††	No	No	No	Yes
Yellow Pine (Long Leaf)	41 lb.	4.9	5.8	2.9	1.9	5.8	1.6	2.2	.2.5	3.0	2.8	1.5	1.0	0.0	—3.6	None	None	None	None	No	Yes††	No	No	No	Yes
Redwood	30 lb.	5.9	6.4	4.5	5.1	7.9	3.6	5.2	3.5	13.0	7.0	5.5	1.1	0.0	—0.9	None	SS†	SS†SB	SS†	Yes	Yes	Yes	Yes	Yes††	No
Hard Maple	44 lb.	8.2	7.9	6.1	5.8	8.3	1.1	4.4	1.5	0.5	4.4	3.5	1.1	0.0	—2.9	None	None	None	None	No	Yes††	No	Yes	No	No
White Oak	48 lb.	6.5	8.3	4.4	2.2	4.8	0.7	1.1	1.0	0.0	1.5	1.0	1.1	0.0	—1.7	None	None	None	None	Yes	Yes	Yes	Yes	Yes††	No

*Observed after 1 week with cold Liquids and 8 hours with hot (boiling).
**Observations made after immersion for 1 month in the cold liquid.
†SS = slightly soft; SB = slightly brittle.
††Yields no color after a short period.

Data for this table from The Hauser-Stander Tank Co., Cincinnati, Ohio and Forest Products Laboratory, Forest Service, U. S. Department of Agriculture.

Books Received

A DIGEST OF THE SOCIAL SECURITY ACT. By Norman T. Raymond and Arthur A. Kimball. Munsey Building, Washington, D. C. 1935. 8 pp., 6x8¾ in.; paper. Free.

Essential features of the Act are presented as a guide for those who employ labor. These features are important to employers because they will be the basis upon which the bureaus responsible for the administration of the Act will formulate their rules and regulations.

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MAINTAINING QUALITY AND UNIFORMITY OF BOTTLED CARBONATED BEVERAGES. By Julian H. Toulouse and Max Levine. Published by American Bottlers of Carbonated Beverages, 224 Southern Bldg., Washington, D. C. 1935. 20 pp., 6x9 in.; paper, illustrated. Price $1.

Known as A. B. C. B. Bulletin No. 8 this booklet contains suggestions on the practical means of testing the raw material ingredients and controlling the quality of the finished beverage during the operations of manufacture.

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WORLD PRODUCTION AND PRICES 1925–1934. By Economic Intelligence Service, League of Nations, Geneva. Published 1935. 146 pp., 8¼x10¼ in. Cloth, illustrated. Price $1.25. Obtainable through World Peace Foundation, 8 West 40th St., New York, N. Y.

Survey of world production activity and prices, comparison of quantitative changes in production and in trade, and an analysis of price tendencies are covered in this report. Included is an appendix giving indexes of the world production of primary commodities.

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WORLD ECONOMIC SURVEY. FOURTH YEAR (1934–35). By Economic Intelligence Service, League of Nations, Geneva. Published 1935. 300 pp.; 6¼x9¼ in. Cloth; illustrated. Price $2. Obtainable through World Peace Foundation, 8 West 40th St., New York, N. Y.

Written independently of its predecessors, this book is intended to inform the general or lay reader of economic developments and events between July, 1934, and August, 1935. Among subjects covered are: Movement of Prices, Adjustment of Agriculture, Recovery of Industrial Production, Wage-Earners Share in Recovery, Reorganization of International Trade, Expanding Basis of Credit, and correlating summaries.

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CHEMICAL ENGINEERING CATALOG. TWENTIETH ANNUAL EDITION. Published by Reinhold Publishing Corp., 330 West 42d St., New York, N. Y. 1935. 864 pp.; 8¾x11¼ in., illustrated; cloth. Price: Free on a loan basis to those holding responsible positions in the Process Industries, which include chemical and food manufacture, in the United States and Canada; $3 to the executives of these industries in other countries and to those in the United States and Canada for permanent possession; $10 to others.

With an increase of nearly 100 pages over last year this edition of the much used equipment catalog sponsored by associated chemical societies blazes forth with a brilliantly colored cover and with colored special stock advertising inserts. The inserts are, in the main, complete catalogs prepared individually by the firms themselves. In effect they liven up and give some individuality to what has heretofore been merely a compilation of reference information on processing equipment and industrial materials. According to the publishers, inclusion of these complete catalogs permits greater flexibility to the arrangement of the text material.

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THE METAL CLEANING HANDBOOK. By Robert W. Mitchell, Technical Director Magnus Laboratory. Published by Magnus Chemical Co., 107 South Ave., Garwood, N. J. 1935. 214 pp.; 6¼x9½ in.; board; illustrated. Price $1.

All food manufacturers have their metal equipment cleaning problems as well as those directly associated with plant sanitation and good housekeeping. How to clean their cooking kettles, baking pans, smoke houses, pumps, motor, drains and the like is not so obvious as is the cleaning of packing tables, wooden trays, floors, and other non-metal equipment. The contents of this booklet are for the purpose of helping to make the cleaning of this equipment less troublesome.

Only a few illlustrations shown refer directly to food plant installations, yet the information and data contained in this handbook applies to metal surfaces regardless of their size, shape, or type of plant in which they are used.

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ALL ABOUT COFFEE. By William H. Ukers. Published by Tea and Coffee Trade Journal Co., 79 Wall St., New York, N. Y. 1935. 818 pp., 7½x10½ in.; illustrated; cloth. Price $15.

Use of coffee as a beverage is one thing; as a flavor for foods is another. However, a book devoted to coffee in all its agricultural, social, and industrial aspects has a breadth of interest that challenges the author of a book on any other subject.

While a goodly portion of Mr. Ukers' book is given to the agricultural and social phases of coffee, the chief value of this second and revised edition, first edition published in 1922, lies in its technological and industrial up-to-dateness. Even flake coffee introduced to the market by The Grand Union Co. during the past month and the "Kondor" tablet coffee introduced in England in 1934, have their day in court in this book.

Contained in one volume, the text material is presented under six book groupings and an 85-page appendix. More than 50 per cent of the contents is devoted to technical, scientific and commercial information and illustrations which include latest types of equipment for cleaning, blending, roasting, grinding and packaging as well as tables containing statistical and technical data.

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THE FUNCTIONS OF A TECHNICAL INFORMATION BUREAU. By E. S. Hedges and C. E. Homer. Published by International Tin Research and Development Council. American office, 149 Broadway, New York, N. Y. 1935. 8 pp. 6x9¾ in. Paper; illustrated. Free.

A GUIDE TO APPLICANTS FOR DIRECT LOANS. Published by National Conference of Business Paper Editors and Associated Business Papers, Inc., 330 West 42d St., New York, N. Y. 32 pp., 8½x11 in.; paper. Price 25 cents.

The government has authorized direct loans to industry but some of the big questions facing industry on this subject are: How can these loans be obtained and through what agency of the government? To what uses may the borrowed funds be put? What interest and service charges have to be paid? What equipment purchases are eligible for loans?

Supplementary to the report "What About Direct Loans to Industry?" recently prepared and distributed by the Committee on Loans, this sixth number of a series of analytical studies dealing with current subjects of business interest answers these and many other pertinent questions. Also it includes case studies of applications for these loans. Published as of November, 1935, this report is strictly current in the information it imparts.

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FIELD WAREHOUSING. A COMMON-SENSE METHOD OF INVENTORY CONTROL. Published by Terminal Warehouse Company of New York, 27th St. and Eleventh Ave., New York, N. Y. 32 pp., 8½x11 in. Paper. Free.

Branch or field warehousing, as a means of inventory financing, has aroused considerable interest in the last few years. This method, which provides new credit possibilities for producers and manufacturers faced with the necessity of borrowing money, has been made possible by means of the Uniform Warehouse Receipts Act, which already has been adopted by all the states except Georgia, Kentucky, New Hampshire and South Carolina. It permits the borrower to create new collateral by arranging to have a public warehouseman take over under bona fide lease the premises in which the produce is stored, and issue negotiable warehouse receipts against it. The operation of the plan, and the procedure that should be followed by producer or manufacturer, are outlined briefly but clearly in the book.

FOOD PACKAGES and PRODUCTS

New

Chocolate Mints. Russian Mints from Lincoln, Neb., are a new contribution to the confectionery market by Bauer. Chocolate all the way through and shaped and decorated like filled chocolate pieces, the candy has a distinctive mint flavor.

"Undoubtedly America's most delicious candy" is what Bauer calls its creation, and while other confectionery manufacturers will debate that point, they must admit that the package for the candy is a fetching one. The top of the box is covered with an embossed paper in cream and white. A red, blue and yellow coat of arms done in Russian style decorates the package, this being balanced by the name of the product in thin black letters and by a thin bar design in red. Inside the box, the dark color of the chocolates contrasts with red paper cups and a red paper lining.

"Wicker" Wine Jug. In keeping with the trend toward greater popularity of gallon and half-gallon containers for wine, vintners are making their jugs more attractive. This is evidenced in the glass demijohn of Fruit Industries, Ltd., Los Angeles, a container decorated in a wicker motif suggestive of the wicker-bound packages traditional in the wine industry. To avoid labeling difficulties, the container is made with a smooth panel on the front.

To assure consumers that they get a genuine product, Fruit Industries seals the jug with a tamper-proof closure, the container being especially designed to accommodate the seal.

Improved Shortening. This month will see the introduction of a new line of shortening by John Morrell & Co., Ottumwa, Iowa. Labeled, "Prido," the shortening is advertised as not only saving 25 per cent in the amount needed for cooking, as compared with other varieties, but as combining the advantages of lard and vegetable shortening while eliminating their disadvantages. To

be more specific, Prido is said to cream quickly, even at refrigerator temperature, to stay moist, to have a pleasant taste and to be easily digested. Used in deep frying, the product does not smoke as quickly as other vegetable shortenings nor within 100 degrees of lard, Morrell states.

Prido will appear on the market in a colorful can decorated with blue, white and silver, a package expected to have much attractive power on the grocer's shelf or in his window.

Backing up the claims for this new product is a money-back guarantee. The shortening will be promoted with an intensive campaign using both magazines and newspapers, with ads in four colors as well as in black and white. A recipe book will be offered and counter display signs will be given distributors.

Symbolic Vinegar Jar. Molded in the shape of a huge apple and decorated with a design of overlapping leaves, the apple-cider vinegar jug of Knouse Corp., Peach Glen, Pa., is suggestive of the product. And enhancing the symbolic motif are curved handles representing tree limbs.

When this container first appeared on the market, it was closed with a plain cork driven flush with the top and sealed with paraffin. But Knouse Corp. later adopted corks with embossed tops because they are more attractive and more convenient for reclosing the jug.

Nuts in Metal Bag. Salted peanuts are being attractively packaged by Imperial Candy Co., Seattle, Wash., in a bag that protects the nuts from staleness caused by moisture and rancidity resulting from the action of light.

This bag is made of paper-backed metal foil with a shiny, silver-colored surface. Printed on the bag in yellow and blue, in contrast with the silver, are the brand name "Société," and two strips illustrating the nuts. The name of the processor, the net weight and a message explaining the function of the metal bag are printed on the reverse side. The bag closes by folding.

Butter Carton. Plenty of empty space surrounds the trade name on the butter carton of Western Dairy Products, Inc., Los Angeles, to give it emphasis and sales appeal. The name itself, "Crescent Butter," is printed in white on a blue panel. Completing the design and tying in with the name of the product are a crescent and a row of stars. Of modern motif, the design of this package for top-grade, unsalted butter is sufficiently simple to be impressive.

Toasted Corn Chips. "Something new from old Mexico" is being made from corn by Toasted Corn Products Co., Washington, D. C. To be eaten straight or to the accompaniment of cocktails or beer, this product is a "stone-ground corn, toasted into a crisp, salted delicacy." It takes the form of large, thin flakes, or chips, and it has a characteristic corn flavor.

Called "Corntos," this product is packaged in a tin with a friction type closure, an all-around paper label and a liner of parchment paper. The label is brightly printed in red and green on white.

Concentrated Flavoring. An intensified pure maple syrup for flavoring ice cream has been put on the market by Natural Sugars, Inc., New York. Called "Maple Freeze," it possesses many times the strength of ordinary pure syrup, according to the distributor. In the process of intensification, which is physical and not chemical, most of the sucrose is removed from the syrup. The ice cream manufac-

PRODUCTS

turers add 1 qt. of the flavoring to 9¾ gal. of mix. No special mix is required, the distributor states.

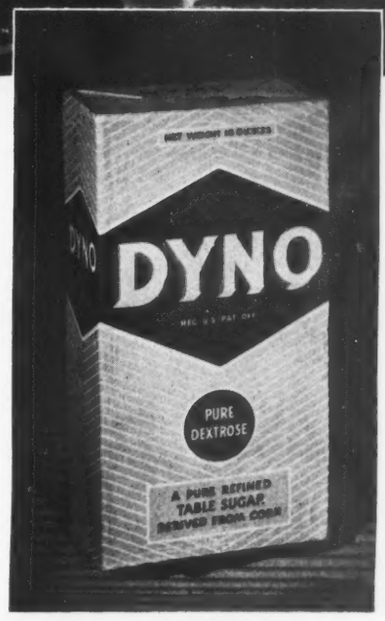
Packaged Strudel. Hungarian strudel has been thoroughly Americanized, having been put on the market in small packages ready for use in the home. The paper-thin dough leaves are put up in window cartons by Continental Food Specialties, Inc., New York, the cartons being wrapped in sealed transparent cellulose to keep the strudel fresh; consumers are cautioned against opening the package before using by a warning on the front of the box.

New Fruit Drink. "Fruit Delight," a carbonated pure fruit beverage, has been announced by California Fruit Foods Co., Los Angeles. Made with genuine fruit syrup, the product is said to have no synthetic or artificial coloring or flavoring. Made in pineapple, grapefruit, orange, apricot, fig, and lemon flavors, the beverage comes in 12-oz. bottles. In addition to being a fountain drink, it is credited with being a good mixer with alcoholic beverages.

Salt From Kelp. A health salt is a new product being extracted from kelp in the Pacific Northwest. Rappe Kelp Laboratories, Inc., Seattle, makes this vegetable salt at a plant on the waterfront from dehydrated and granulated kelp. To be used in place of ordinary table salt, it is reported to contain numerous mineral elements.

Carrot Preparation. Carrots in a new form is an innovation by Pasharts, La Grange, Ill. Processed to a state of semi-solidity and semi-solubility, the carrots are ready to serve or to be used in pie fillings, cakes, desserts, soups, salads or what you will. Called "Carrot Harts," the product is packed under vacuum in 15-oz. glass jars and in No. 2 tin cans, the latter containing 1 lb. 4 oz.

Apple Juice. "Drink an apple a day to keep the doctor away" might well be the slogan for a new beverage being supplied to an expanding market by Pommerelle Co., Seattle. This company extracts juice from apples and sells it without sweetening it or letting it ferment to cider. The company promotes the beverage as an appetizer with meals and as a drink to be served to evening guests. The apple juice is bottled in quarts, packed twelve to a case.



Corn Sugar for Table. Corn sugar is being put on the table to take the place of sucrose by Corn Products Sales Co., New York. Labeled "Dyno," the dextrose is put up in cardboard cartons wrapped with paper on which the label design is printed, the wrapper being tightly sealed as protection against moisture. Introduced a few weeks ago in Hartford, Conn., Dyno was promoted to a "satisfactory" distribution through newspapers and radio. If the preliminary results continue, distribution probably will be extended. Promotional literature for Dyno presents it as a "quick fuel" which gives vitality.

A Honey. Crystal-clear honey in a container that advantageously displays the clarity is a development of Holsum Products, Milwaukee. The honey itself is processed to remove excess wax, pollen and other foreign material found in ordinary honey, leaving a highly transparent golden fluid. The jar in which it is marketed bears only a small label on the front panel, this permitting a clear view of the contents. To identify the product at a glance, the side panels of the jar carry the likeness of honey comb molded into the glass, and the front and rear panels bear the semblances of hives and of bees in flight. A white metal screw cap completes the package.

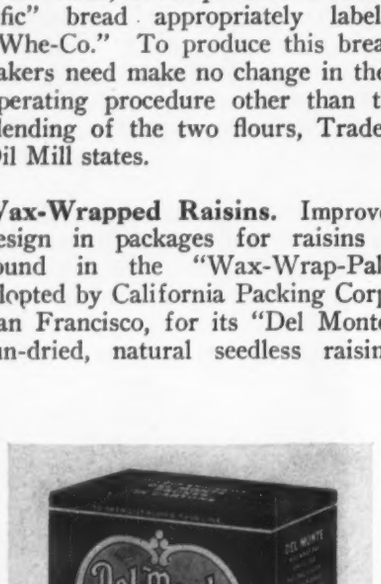
Cottonseed Flour. Out of the South comes again a human food made from the seed of cotton. "CoFlo," a partially defatted, cooked cottonseed flour has been put on the market for bakers by Traders Oil Mill Co., Fort Worth, Texas. This is not the first flour of this kind to be made, but it represents a separate development, the manufacturer says.

The analysis of the product, as given out by the manufacturer, shows it to contain protein, 50 per cent; fat, 7.5 per cent; carbohydrates, 26.4 per cent; ash, 6 per cent; crude fiber, 2.1

per cent; moisture, 8 per cent. As for special nutritive value, it is credited with containing half as much vitamin B as the best yeast and with carrying vitamin G. Being low in starch, it finds favor among those people whose waistlines are getting out of round.

Blended one part to three parts of wheat flour, CoFlo produces a "scientific" bread appropriately labeled "Whe-Co." To produce this bread, bakers need make no change in their operating procedure other than the blending of the two flours, Traders Oil Mill states.

Wax-Wrapped Raisins. Improved design in packages for raisins is found in the "Wax-Wrap-Pak" adopted by California Packing Corp., San Francisco, for its "Del Monte" sun-dried, natural seedless raisins.



The wrapper for the carton is given a thorough soaking in a high-melting-point wax before being applied. After sealing, it forms a "wax" envelope around the whole carton, protecting the raisins against loss of moisture and infestation by insects. In addition to having these technical attributes, the new wrapper, printed in the traditional Del Monte green and red, makes a striking appearance.

Suggestive Label. Having selected for its "improved" hydrogenated peanut butter a name famous in the comic strips, Rose Field Packing Co., Ltd., Alameda, Calif., decided to capitalize to the greatest extent by adopting a label design suggestive of the name. The peanut butter is put up in a tin whose label pictures a board fence on which is painted in rough, free-hand letters the trade-name "Skippy." The likeness of a paint bucket on the ground by the fence completes the scene. The package is closed with a friction-type lid with the rim raised at three places to permit easy insertion of a pry-off instrument. The flat, unbroken surface of the lid carries a sales message.

Informative Labels. A new idea in canned oyster labels has been brought out by Wiegardt Bros., Oysterville, Wash. This canner puts up three different packs of oysters, one of which is labeled "half dozen," another, "seven-nine," and the third, "best for soup." These names tell the purchaser how much and what he is getting. The half dozen variety is packed six to a can for four ounces and is especially recommended for frying. The seven-nine pack contains that number of oysters with a net weight of 5 oz. The "best for soup" brand indicates the purpose of the oysters which the 8 oz. can carries.

Lemon Juice in Tins. It is now unnecessary for consumers to operate an extractor to obtain lemon juice, a can opener being the only implement necessary. Seeman Bros., Inc., New York, is marketing the juice in tins. Containing four ounces, the cans are lined with enamel of the type used in cans for corn, such a lining being necessary to keep the citric acid out of contact with the metal. The juice is packed in the fruit growing district by Absopure Fruit Products Co., Anaheim, Calif.

Food for Decoration. Fancy colors in processed foods usually go no farther than the package, but that is not true of "Puffles." This new food of Puffles, Inc., Chicago, is made in a wide variety of striking hues intended to make an attractive decoration on the table and to provide something different in a garnish for salads, desserts and meats. In the form of chips, this product is prepared for consumption by six seconds of deep frying. This operation puffs the chips, hence the name.

Puffles are made in three varieties —fruit, vegetable, and cheese. All are made from a health flour, but with a variance in other ingredients. Fruit Puffles contain fruits, honey, milk, nuts and other ingredients. The vegetable variety embodies spinach, lettuce, carrots, celery, mushrooms and tomato juice. Cheese Puffles, as might reasonably be expected, contain cheese.

The manufacturer that makes this unusual product also has another new one. It is "Fry-ems," which are partially cooked, sliced potatoes. The idea is that the housewife can fry them into strictly fresh chip potatoes in 30 seconds.

Vitamin C Jam. Concentrated vitamin C in an unusual form is being exported to this country by "Ocean" Hungarian Preserve Works & Trading Co., Ltd., Budapest. The concentrate is known as "Vitapric," and it is made from paprika. A jam-like substance with a red color, it may be eaten straight or served as a sauce with foods deficient in the anti-scorbutic vitamin.

PATENTS

Cashew Nut Shell Liquid Utilized as Constituent of a Resinous Mass—Frederick M. Damitz to Harvel Corp., Irvington, N. J. No. 2,014,370. Sept. 17, 1935.

Automatic Doughnut Cooking Machine Comprised of a Continuously Traveling Mold in Which the Doughnuts Are Cooked—John Krüttschnitt, San Mateo, Calif. No. 2,014,384. Sept. 17, 1935.

Packaged Foods Frozen by Contact With Parallel Movable Belts to Which Refrigerant is Applied on Outer Surfaces—Clarence Birdseye and Bicknell Hall, Gloucester, Mass., to Frosted Foods Co., Inc., Dover, Del. No. 2,014,550. Sept. 17, 1935.

Resilient Foods Packaged by Being Forced Into Space Less Than the Finished Package and Then Allowed to Expand After the Package Has Been Lap-Sealed—Frank A. Chekian, Modesto, Calif. One-half to Consolidated Packing Co., San Francisco, Calif. No. 2,014,555. Sept. 17, 1935.

Milk and Cream Deodorized by Spraying With Steam Into Units Operating With Centrifugal Action and Under Sufficient Vacuum to Keep Water Content Uniform, But With Removal of Volatile Vapors and Gases—Henry Lamont Murray, Auckland, N. Z., to Te Aroha Dairy Co., Ltd., Te, Aroha, N. Z. No. 2,014,580. Sept. 17, 1935.

Candy Wrapped With End Folds And Impaled Upon Stick Inserted Through an End Fold During Wrapping Operation — Walter H. Sergent to Fair Play Caramels, Inc., Middletown, N. Y. No. 2,014,593. Sept. 17, 1935.

Non-Settling Chocolate Syrup Made by Incorporation of Protective Colloid Suspension Containing Swelled Starch—David E. Linn, La Grange, Ill., to International Development Co., Wilmington, Del. No. 2,014,623. Sept. 17, 1935.

Shelled Eggs Preserved by Impregnation With Highly Atomized Oil Treatment—Herman B. Christian, Oakland, and Harry E. Kennedy, Berkeley, Calif., to Harry E. Kennedy. No. 2,014,646. Sept. 17, 1935.

Refined Sago Starch Prepared by Treatment With From 1 to 6 per cent Available Chlorine on Dry Basis Weight of Starch Preliminary to Removal of Impurities and Drying—Arthur D. Fuller, New Rochelle, N. Y., to National Adhesives Corp., New York, N. Y. No. 2,014,798. Sept. 17, 1935.

Gelatinous Starch in Powder Form Subjected to Chlorine Gas Preliminary to Dexterinazation Through Application of Heat—Arthur D. Fuller, New Rochelle, N. Y., to National Adhesives Corp., New York, N. Y. No. 2,014,799. Sept. 17, 1935.

Raw Sugar Crystals Freed From Impure Syrup by Controlled Washing With Purified Sugar Syrup — Louis Hyve, Marseille, France. No. 2,014,897. Sept. 17, 1935.

Honey Incorporated Into Butter During Churning Operation — Harry A. Lipson, Cleveland, Ohio. No. 2,014,902. Sept. 17, 1935.

Ice Cream in Cylindrical Form Wrapped Continuously by Paper in Strip Form Being Formed Into Cylindrical Containers During Packaging Operations—August J. Asmussen and Thomas G. Paolillo, Brooklyn, N. Y. No. 2,014,961. Sept. 17, 1935.

Selective Hydrogenation of Oil Obtained by Heating to 200 to 400 Deg. F. With Agitation and Catalyst and Maintaining an Inert Gas in Space Above Oil—Matthew G. Barrabas, San Leandro, Calif., to Best Foods, Inc., New York, N. Y. No. 2,014,999. Sept. 17, 1935.

Cheese Powdered by Spray Drying—Forest H. Clickner, to Kraft-Phenix Cheese Corp., Chicago, Ill. No. 2,015,256. Sept. 24, 1935.

Bakery Products Filling Containing Not More Than 1 per cent Moisture Made From Powdered Cheese, a Dry Edible Fat And a Stiffening Filler—Forest H. Clickner, to Kraft-Phenix Cheese Corp., Chicago, Ill. No. 2,015,257. Sept. 24, 1935.

Powdered Cheese Compounded With a Dry Edible Fat to Form Food Ingredient—Forest H. Clickner, to Kraft-Phenix Cheese Corp., Chicago, Ill. No. 2,015,258. Sept. 24, 1935.

Relatively Large and Small Pieces of Cured Ham Molded Into Loaf Form With a Layer of Caul Fat and Parchment Wrapping—Charles H. Vogt, to Modern Food Process Co., Philadelphia, Pa. No. 2,015,297. Sept. 24, 1935.

Sugar Solutions Clarified by Ammonium Oxychloride—Herman F. Bomonti to Bomonti Co., Ltd., Honolulu, T. H. No. 2,015,375. Sept. 24, 1935.

Flaked Cereals Sterilized During Flaking Operations and at a Temperature Not Destructive to Vitamin Content—David Idwal Thomas, Penygraig, Wales. No. 2,015,388. Sept. 24, 1935.

Combination Fruit Feeding and Slicing Machine—John W. Pease, Rochester, N. Y. No. 2,015,409. Sept. 24, 1935.

Human Breast Milk Preserved in Compact Wafer Form by Quick Freezing With Solid Carbon Dioxide—Washington Platt, Syracuse, N. Y., to Borden Co., New York, N. Y. No. 2,015,496. Sept. 24, 1935.

Tea Packaged in Non-Tangling Bags—Walter Mason Ingram to Millie Patent Holding Co., Inc., New York, N. Y. Nos. 2,015,853 and 2,015,854. Oct. 1, 1935.

System for Automatically Controlling a Series of Coordinated Operations—William J. Kerr to Bristol Co., Waterbury, Conn. No. 2,015,855. Oct. 1, 1935.

Method of Preparing Jelly Products in Variety of Shapes—Albert Leo, Chicago, Ill. No. 2,015,857. Oct. 1, 1935.

Method of Making Vitamin B Concentrate—Barnett Sure, Fayetteville, Ark., and Elmer H. Stewart, Indianapolis, Ind., to Barnett Sure. No. 2,015,876. Oct. 1, 1935.

Means for Slicing Cabbage for Sauerkraut—John Nazzoco, Trinidad, Colo. No. 2,016,114. Oct. 1, 1935.

Prepared Bakery Product Mixes Made From Emulsified Molasses and Shortening, Eggs, Flour and Flavoring Ingredients — John D. Duff, Pittsburgh, Pa., and Lewis E. Dietrich, Crafton, Pa., to P. Duff & Sons, Inc., Pittsburgh, Pa. Nos. 2,016,318; 2,016,319, and 2,016,320. Oct. 8, 1935.

Beverages Carbonated Under Temperature and Pressure Conditions to Increase the Gas-Absorbing Capacity—George L. N. Meyer, Milwaukee, Wis. No. 2,016,384. Oct. 8, 1935.

Electrically-Heated Knife for Uncapping Honey—Roy Stringer, one-half to Wallace M. Smith, Plantaganet, Ont., Canada. No. 2,016,523. Oct. 8, 1935.

Pineapple Juice Treated for the Manufacture of a Syrup and Recovery of Citrates—Charles S. Ash and Edward P. Roleson to California Packing Corp., San Francisco, Calif. No. 2,016,584. Oct. 8, 1935.

Lactose Crystallized in Powdered Milk Without Coagulation of Albumen—Faw Yap Chuck to Western Condensing Co., Petaluma, Calif. No. 2,016,592. Oct. 8, 1935.

Preventing Sugar Deterioration During Storage—James T. McDowell, Herman L. Hartburg, George W. Rienks, and Joseph Maudru, Denver, Colo. No. 2,016,608. Oct. 8, 1935.

Sugar Solution Treated to Increase the Amount of Lime-Sugar Precipitate—Sherman Chase Meredith, San Mateo, Paul Warren Alston, Concord, and Edward Taber Winslow, Saratoga, Calif., to Spreckels Sugar Co., San Francisco, Calif. No. 2,016,609. Oct. 8, 1953.

Cheese-Making Unit Composed of a Rotatable Cylinder Vessel and a Temperature Regulating Device Mounted on Interior of the Cylindrical Vessel—Wilhelm Nilsson, Sundsvall, Sweden. No. 2,016,612. Oct. 8, 1935.

Caffein-Free Coffee Produced by Extraction With Mixture of Acetic Ester and Water After Steaming, Then Drying to Temperature of 40 to 45 deg. C. and Finally From 80 to 135 deg. C.—Theodore Grethe, Hamburg, Germany. No. 2,016,634. Oct. 8, 1935.

Eggs Mechanically Graded According to Weight — William F. Neuhaus, Augusta, Wis. No. 2,016,789. Oct. 8, 1935.

Method For Growing of Seed Yeast—Henry Riley by Edith M. Riley, Administratrix, Kearny, N. J. No. 2,016,791. Oct. 8, 1935.

Bread Dough Subjected to Rolling Motion During Proofing — David J. Hanna and John M. Van Houten to Dutchess Tool Co., Beacon, N. Y. No. 2,017,046. Oct. 15, 1935.

Metal Food Containers Sterilized by Electricity—Godfrey Steerup, Maywood, Ill., to American Can Co., New York, N. Y. No. 2,017,079. Oct. 15, 1935.

Double-Wall Sausage Casing Made by Sewing Together Longitudinal Strips With Staggered Seam Laps—Gustav F. Peters and Otto Reissner, St. Paul, Minn. No. 2,017,162. Oct. 15, 1935.

Oysters Opened Mechanically—Friedrich W. Mittel, Brooklyn, N. Y. No. 2,017,370. Oct. 15, 1935.

Mechanical Means of Determining Bacterial Content of Air—William F. Wells, Cambridge, Mass. No. 2,017,483. Oct. 15, 1935.

Adjustable Cheese-Cutting Machine — Norris Earl Wines, East Cleveland, O. No. 2,017,642. Oct. 15, 1935.

Roasted Coffee Impregnated With Steam While Hot in Roasting Chamber—Patrick T. Clary, Carnegie, Pa. No. 2,017,892. Oct. 22, 1935.

Eggs Opened and Separated by Mechanical Means—George Weiss, Chicago, Ill. No. 2,018,044. Oct. 22, 1935.

Oil Extracted From Cashew Nutshells Without Scorching Nut Kernels—Thomas M. Rector, Rutherford, N. J., to Baker-Bennett-Day, Inc., New York, N. Y. No. 2,018,091. Oct. 22, 1935.

Liquid Foods Irradiated Under Mechanically Controlled Conditions — Henning A. Trebler, Baltimore, Md., and Carl J. Larsen, East Orange, N. J., to Hanovia Chemical & Manufacturing Co., Newark, N. J. No. 2,018,332. Oct. 22, 1935.

Milk Subjected to Bacterial Peptinization and Lactic Acid Fermentation For Formation of Bakery Product Ingredient—Alexander Axelrod, Zurich, Switzerland. No. 2,018,394. Oct. 22, 1935.

Starch-Deposited Candy Centers Cleaned by Screening and Brush Action Operating Through an Inclined Plane — Edward D. Rapisarda, Agawam, Mass. No. 2,018,418. Oct. 22, 1935.

Candy Protected From Temperature Changes by Air Space In Double Walled Packing Box—Harper M. Hall, Brooklyn, N. Y. No. 2,018,519. Oct. 22, 1935.

Method of Packaging Cheese in Relatively Small Units to Prevent Mold Growth by Utilizing Preservative Gases Liberated From Cheese—Charles M. Boane, Salem, Ore. No. 2,018,637. Oct. 22, 1935.

Ice Cream Portion Mechanically Molded Into Cone Shape — Clarence M. Vogt, to Vogt Processes, Inc., Louisville, Ky. No. 2,018,751. Oct. 29, 1935.

Raw Sugar Solutions Freed From Invert by Yeast Fermentation—Holger de Fine Olivarius to California Packing Corp., San Francisco, Calif. No. 2,018,869. Oct. 29, 1935.

Means for Making Hollow Sandwich Roll—Romeo J. Couture, one-half to Richard J. Talbot, Springfield, Mass. No. 2,018,950. Oct. 29, 1935.

Method for Separating Germs From Wheat Berry—Edward Jacob Miller, Clinton, Mo., Harry L. Goodwin, Sr., Chicago, Ill., and Edgar Martin Miller, Clinton, Mo. No. 2,018,966. Oct. 29, 1935.

Means for Abrasive Cleaning of Eggs—Edward E. Miller and Vere C. Miller, Bryn Mawr, and John E. Powell, Issaquah, Wash., to National Poultry Equipment Company. No. 2,018,967. Oct. 29, 1935.

Extruding Machine for Forming Lard and Similar Edible Fats Into Units of Predetermined Size—Carl Drohmann and Karl Munz, Stuttgart-Wurtemberg, Germany. No. 2,019,002. Oct. 29, 1935.

Some examples of unique design that cash in on truck's advertising value

Dressing Up the Truck

to Attract Attention

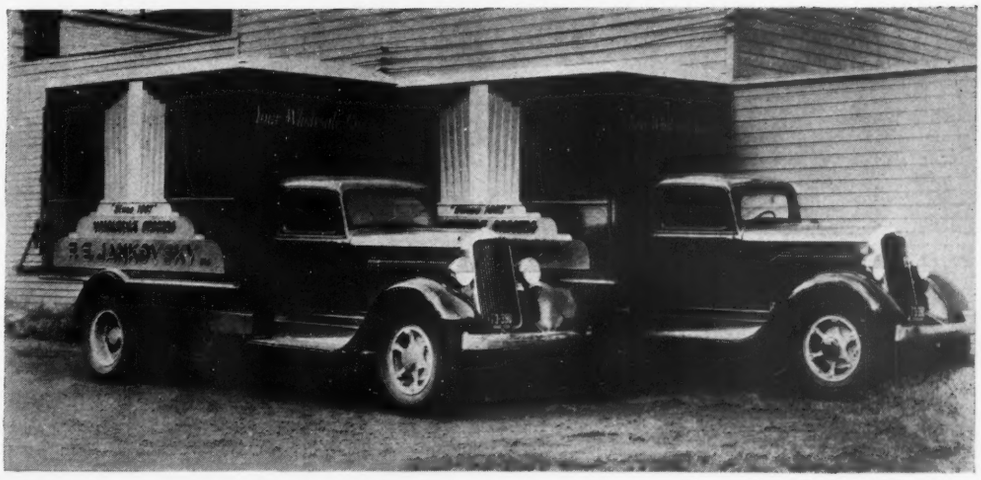
Above: Lack of advertising except for one small line features this pure white step-in-drive Dodge as used by the Purdue University Creamery, West Lafayette, Ind.

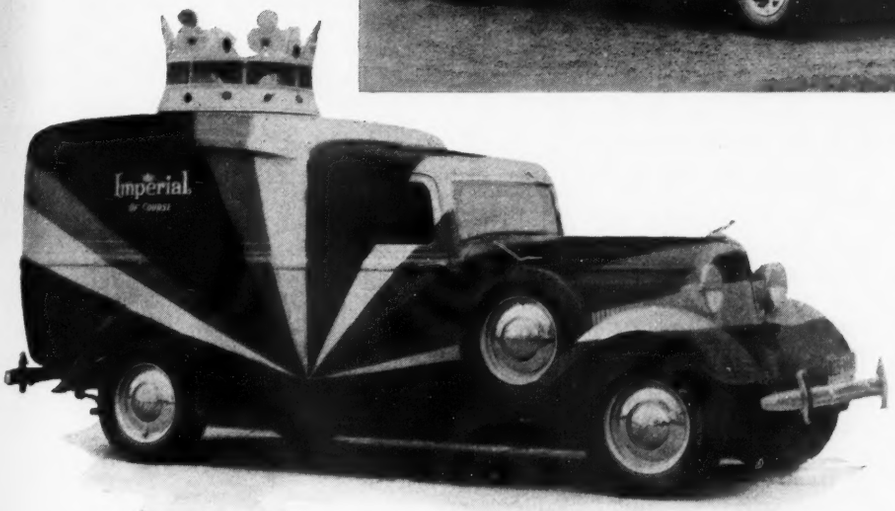
Left: Here is the latest in water wagons, a Ford truck used to deliver bottled spring water to exhibitors at the California—Pacific Exposition at San Diego, Calif.

Right: Out of Austin, Minn., this George A. Hormel & Co. Ford tractor and semi-trailer carries a 7½-ton payload in the fully insulated body refrigerated by means of dry ice.

Left: Easy loading and unloading combined with neatness of appearance and good proportions distinguish this Ford tractor and semi-trailer used by the Globe Grain & Milling Co., Los Angeles, Calif.

A modernistic side panel paint layout as used by F. E. Jankovsky, Inc., wholesale grocers in Cleveland, Ohio.





Left: No, those are not shadows on the truck. They are rainbow colors as used by the Imperial Ice Cream Co. of Parkersburg, W. Va., on a Dodge traveling through West Virginia, Ohio, Virginia, Kentucky and Pennsylvania. Note also the crown of metal and copper screen in gold leaf on the roof to house a loud speaker and amplifying outfit for records.

Right: Shelves, side and rear doors feature this insulated body mounted on a Dodge chassis used by Hoffman Bros., Sandy Market, Portland, Ore.

These three Dodge tractors and trailers carry the striking trademark of Stokely's food products of Indianapolis, Ind.

Practical Problems of
TRUCK TRANSPORTATION

DISCUSSED BY EXECUTIVES IN THE FOOD INDUSTRIES

Methods for Reducing Truck Accidents

Question No. 13

1. What fundamental practices have you found essential in reducing truck accidents?

2. Do safety committees, company traffic courts or safety contests with buttons or cash prizes really help to reduce accidents?

3. Does it pay to give drivers who have had accidents time-off without pay instead of discharging them?

4. What percentage of accidents in your truck fleet has been due to mechanical failures?

5. Of what value in reducing accidents are mechanical or electrical directional signals?

Safety Campaign Effective

IN reply to your questions regarding methods for reducing motor vehicle accidents, we are giving you our findings:

1. We find that operating a safety campaign among drivers will reduce accidents.

2. We are adopting safety means where a driver receives a cash award for going one year without an accident.

3. We penalize the driver three days lay-off for an accident, and in case of a very serious accident, he is discharged.

4. None of our accidents are due to mechanical failures or defects. We wish to state that all our mechanical equipment is kept in first class condition.—R. M. SEEKER, *Director of Personnel, Anheuser-Busch, Inc., St. Louis, Mo.*

Mental Attitude Important

FROM many years of experience and close association with the subjects of automobile accidents and safe driving, we feel it is of major importance that men driving our automobiles have the right mental attitude, that they be fully inspired with the necessity of driving safely and that they possess a very keen sense of responsibility for driving safely in relation to the public, their company, themselves, their families and co-workers. We find these qualities are attained and reach the state of perfection over a period of years with many men through energetic effort directed along the following lines:

a. By talking about the subject to the men as a group.

b. By talking about the subject to them individually.

c. By having the men realize in a very definite manner that the management is very much safety-conscious and is fully aware of all accidents that occur.

d. By having the men realize that their supervisors and foremen are very safety-conscious.

e. By supervisors and foremen showing a personal interest in their men, knowing their problems and helping to solve them.

f. By safety posters, some of which should be original.

g. By safety messages in the cars or trucks.

h. By the distribution of literature on the subject directly to the men. Some of this literature furnished by National Safety Council and large insurance companies is very interesting and helpful.

i. By careful review of accidents, not only those in which our men and equipment are involved but all accidents in which there is an object lesson.

j. By giving individual driving instructions in cases where it is indicated that individual instruction is necessary.

k. By seeing to it to the best of our ability that our men are in good physical condition.

2. Safety committees, company traffic courts and safety contests are all helpful. Each one of them is another step in the right direction. Safety awards are very much appreciated, and it is surprising how our men guard their records and look forward to receiving these awards at the end of a given period.

3. Time off without pay, coupled with instruction and guidance, is a better solution than discharging drivers except in cases where the man shows evidence of viciousness and has obviously the wrong mental attitude.

4. Over the years, very few of our accidents have been due to mechanical failures. The condition of our fleet is excellent, as we realize the importance of careful and thorough maintenance. We feel it is definitely the management's contribution to our safety program to keep our equipment in splendid condition, and in doing this we give our men confidence in the equipment which we ask them to drive for us.

5. We are not strongly in favor of mechanical or electrically operated directional signals because men are inclined to rely too much upon them, whereas they should depend upon their own resources. In most instances it is not merely a matter of showing a signal of one sort or another but it involves judgment; and a good, careful driver should be in a position to think quickly and act quickly so that he not only does not cause accidents but is in a position to help others in the line of traffic to avoid them.—PAUL E. FERBER, *Hoffman Beverage Co., Newark, N. J.*

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Separate Salesmen Or Peddle Truck Routes

Question No. 14

1. In the distribution of food products such as fresh meats, prepared meat products, butter, eggs, cheese, poultry, ice cream, milk, bread and potato chips to retail store outlets, is it better to employ peddle truck routes on which the driver also takes the orders than to use a separate corps of salesmen to solicit the business with the truck driver simply delivering the goods? If so, why?

2. Which method provides the lowest cost per hundred pounds delivered?

3. Can the separate corps of salesmen, if provided with cars at company expense, or allowed mileage for privately-owned cars, procure sufficient additional business to offset the motor vehicle expense as compared with peddle truck routes with driver salesmen?

4. Or is a combination of both salesmen and peddle truck route driver salesmen the most desirable method of distribution?

Driver Salesmen Effective

FOR a good many years I have been connected with the distribution of milk and its by-products to the retail trade. I believe the most economic and satisfactory method of securing and holding new business is through the medium of employing driver salesmen.

There are a good many things to be taken into consideration in making a comparison between a group of salesmen and driver salesmen. A salesman's main object is to sell. Collections are of secondary consideration. However, a

driver salesman is not only interested in sales but also in collections.

In the past I have paid salesmen an average salary of $20 per week plus 5 cents per mile for the use of their own car. The business brought in by these men cost me about $2.50 per quart. In a good many cases, after securing the business, the salesman never meets the customer again.

In the case of business secured by drivers, it is an entirely different matter. In addition to their regular salary, they receive $1 per quart for all new business, as well as a commission on all collections.

Practically all my drivers come in personal contact with at least 80 per cents of their customers at least once a week. The customers get to know their milkman, and if he is an obliging, honest, courteous and neat-appearing chap, he will be able to sell his customers all their dairy requirements direct from his wagon. He will also be able to secure new business through the recommendation of his present well satisfied customers.

I sincerely feel the best and cheapest way to distribute milk to the retail trade is by employing only driver salesmen.—A. C. DERSCH, *Korts Dairy Products, Rochester, N. Y.*

Separate Salesmen Better

WE can give you only our experience in the distribution of our product.

1. We find it far better to employ a separate corps of salesmen to take the orders and to deliver by truck or ship the merchandise. In our business there are several reasons for this conclusion:

First, there are so many numbers in our line that it is almost impossible to have a truck large enough to carry a full assortment to serve the trade, and the back calls limit the operation of truck distribution to a short radius from source of supply.

Another reason of equal importance is that the type of salesman we want to represent us does not care to drive a truck and handle the delivery of merchandise.

Third, we found that the distribution of merchandise by the salesman slowed him down to the point where he was unable to cover sufficient territory.

We have tried out the salesman delivery distribution in the city, small towns and country territories and have given it up in every case as not being practical in its application to our line of merchandise.

2. The driver salesmen method costs less than to have to employ separate salesmen and make independent deliveries.

3. Our experience has been that the separate corps of salesmen can do a much more efficient job and secure so much more business than the driver salesmen that we use the separate corps of salesmen exclusively.—L. O. HASKINS, *Sales Manager, Hampton Cracker Co., Louisville, Ky.*

Prefers Driver Salesmen

WE are glad to give our views on the questions in your inquiry as follows:

1 & 2. Driver salesmen are more desirable in distributing dairy products than having separate salesmen out and using truck drivers to deliver. The average truck driver can lose more business than a salesman can gain.

3 & 4. We do not feel that, in our line, it is possible to secure enough business to warrant separate salesmen, so the best method is to have driver salesmen with one sales director to supply needed information and to call on some of the hard ones to keep them in line.—ARTHUR FRITZEL, *Fritzel Dairy Products, Lawrence, Kan.*

Considers Several Factors

YOU ask certain questions in regard to merchandising food products.

1. In certain markets we operate by means of driver salesmen who sell, deliver and collect at the same time. In other markets we sell by means of foot salesmen, and deliveries are made by regular delivery trucks, generally the following day.

2. The foot salesman's selling costs less per 100-lb. as sales are generally made in larger units, but the territory is not covered as thoroughly.

3. The fact is that the driver salesman sells mostly to the smaller trade where he can get a better price for the merchandise to cover his extra expense of running the truck. The foot salesman, either operating his own car or on a mileage arrangement, contacts the larger trade, and, therefore. his selling expense is less.

4. Our experience shows that in certain markets selling off trucks is the most practical, while in other large markets selling by means of foot salesmen is better. It all depends on the type of merchants, extent of territory and class of merchandise handled.—H. F. MEYER, *Director of Sales, Land O'Lakes Creameries, Inc., Minneapolis, Minn.*

Both Systems Useful

ON SOME of our routes we employ driver salesmen on delivery trucks and on others we have a separate corps of salesmen. Each method seems to have its place and we have not yet concluded which method better suits our needs, or which method is cheaper.

To elaborate somewhat—eggs are somewhat bulky. The nature of our business is such that on some of our routes we can load a large truck to capacity and deliver in multiples of the 1-30 dozen case. Some commodities are less bulky and are delivered in smaller units. In this classification are butter and cheese. Where deliveries of butter and cheese are made, in multiples of a few pounds each, then the salesman-delivery combination is, we believe, far superior to the other type.—JOHN LAWLER, *General Manager, Poultry Producers of Central California, San Francisco, Calif.*

Combination Desirable

I DO NOT believe the question as to whether separate salesmen or driver salesmen are preferable can be answered one way or the other, because the answer must be arrived at by considering the product involved, the customs in the territory involved, and the geographical set-up of the territory. It seems to me that where a product is of a perishable character and the stock must be checked at frequent intervals, the driver salesman might be used to good advantage. On the other hand, if the product is not of a perishable nature and does not require frequent checking and arranging for display purposes, the product can best be sold by one man and delivered by another man. Also, it seems to me that custom of the trade and of the locality must be considered.

I believe you will find driver salesmen working off of delivery trucks costing more per hundred pounds than the salesman using a car and a delivery man using a truck. However, it is questionable if this is quite the right way to figure the expense.

Probably a combination of both methods is desirable in some places where the product involved, custom of the trade and geographical set-up will permit of this being done.—H. H. FERGUSON, *Kingan & Co., Indianapolis, Ind.*

Next Question

QUESTION NO. 15

What is the best method of providing salesmen with cars?

1. Is it best for the company to own the car and pay all the expenses incidental to its operation; to pay only a certain part of the expenses; or to have the salesman own the car and pay him so much per mile or per week?

2. Is the best method also the most economical?

3. If the car is company-owned and maintained, what precautions can be taken to prevent its being used by the salesman for his personal affairs or pleasure?

4. How important do you consider the advertising value of a salesman's car, and how may the greatest advertising value be obtained from it?

BUSINESS TRENDS

Butter Shortage Appears

PRODUCTION of butterfat has fallen off considerably during the past month, and with it the production of butter. For instance, during the week ending Nov. 9, the 242 plants reporting to the American Association Creamery Butter Manufacturers, produced 5,107,296 lb. of butter, off 26 per cent from the 6,935,993 lb. made in the preceding week. During the four weeks' period, the Chicago price advanced about 6 cents, while New Zealand butter prices decreased with the approach of the Antipodean summer. The present spread, at 11 cents, is again approaching the import point, and unless something occurs to shift the situation, foreign butter may again appear on the American market, as it did last winter. Also, higher butter prices may bring the same consumer shift to oleomargarine that was so evident during the winter of 1934-1935.

Many causes are advanced as responsible for the present low production of butterfat, with no one reason finding general acceptance. Some say that the pasturage last summer, and also the hay and fodder crops, were rank and did not contain the usual amount of nourishment. Another reason, put forward by farmers in the Northwest, is that the 1934 drought half starved many of the cows, so that many did not come with calf this year and have gradually gone dry as the year progressed.

Still another reason for the butter shortage, and one that seems to be borne out by the packers' statistics, is that an unusual number of milk cows are being butchered, because of the very good beef prices. Usually, milk cows bring about 1 cent a lb. for canning purposes, while this year they bring 3½ to 4 cents per lb. for the fresh meat demand. Add to this the effect of the corn-hog control on the feed situation, and the temptation for some farmers to sell milk cows rather than to produce butterfat seems to be sufficient to be effective in curtailing butter production.

According to one large New York distributor, the situation with respect to the cream supply in the Metropolitan District is sufficiently serious to cause the development of new sources of supply in order to meet the normal market demand. Cream is consequently being brought in from regions of the country that have not formerly supplied this commodity to the New York and Boston markets.

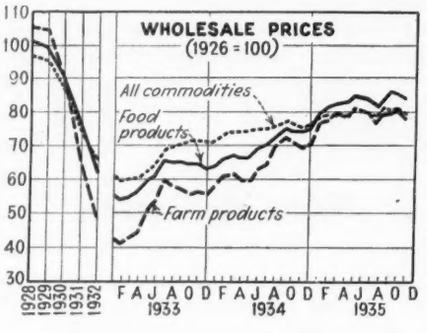
The shortage situation is not alone effective in the butter and cream supply. While market milk still seems to be available in ample quantity, an acute shortage has developed in the New York market with respect to canned milk and other milk products. This is causing an increase in the price, as was shown in the latter part of November, when advertised brands of evaporated milk jumped to $3 per case, with independent brands quoted at $2.85, and milk powder reached 9 cents per pound. One factor that is said to have influenced this price rise has been the unusually warm Fall, with consequent lengthening of the season of good demand for ice cream.

Fats and Oils Still Rise

WAR in Africa, causing shortage or prospective shortage of various vegetable oils, has reinforced the price rise already noted in edible fats and oils. Lard, as pointed out previously, is in short supply. Added to this, coconut oil and copra production is below demand and planters are endeavoring to increase their output; while palm oil supplies are also short.

As a result of this situation, coconut oil has advanced sharply during the past month, and palm oils have increased as much as 25 per cent. Olive oil has increased in price, in spite of the larger olive crop. Butter and lard prices have advanced, in Europe as well as in this country.

In spite of the war-born demand for these products, however, no actual shortage is to be expected in the United States. But firm prices are likely to hold for some months.



Fisheries Move Upward

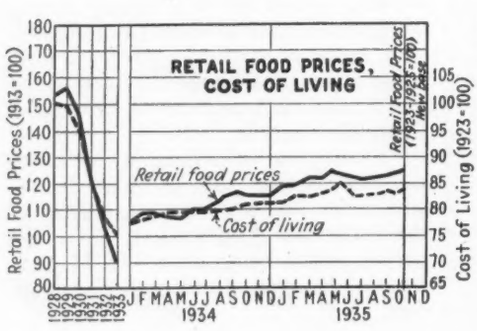
FISH landings are still running ahead of last year, the most recent figures for New England ports given by the Bureau of Fisheries showing a quantity 18 per cent over the same month of 1934 and a value 24 per cent greater. This is a continuance of a trend marking the fishihg industry during recent years.

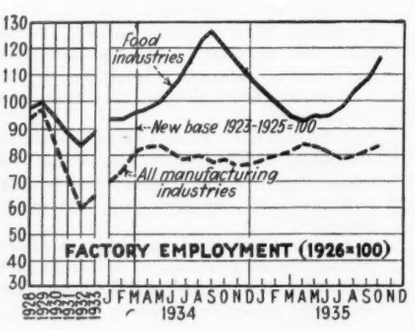
In a publication of the Bureau of Fisheries, "Fishery Industries of the United States, 1934," recently issued, this trend is evident. The report gives complete figures for fisheries in 1933 and shows a total catch for that year of 2,900,000,000 lb., 13 per cent above the 1932 total. The increase is reported to have been mostly on the Pacific Coast, and to have consisted primarily of salmon, pilchard and mackerel.

Canned fishery products moved up 37 per cent in 1933 over the preceding year, and frozen fish production increased 14 per cent.

Meat Situation Eases

Two factors apparent in the meat packing field have acted to relieve somewhat the tight situation that has existed there


RETAIL FOOD PRICES, COST OF LIVING
Retail Food Prices (1913=100)
Retail Food Prices (1923=100) New Base
Cost of Living (1923=100)
Retail food prices
Cost of living
1928 1929 1930 1931 1932 1933
J F M A M J J A S O N D J F M A M J J A S O N D
1934
1935


Food industries
New base 1923-1925=100
All manufacturing industries
FACTORY EMPLOYMENT (1926=100)
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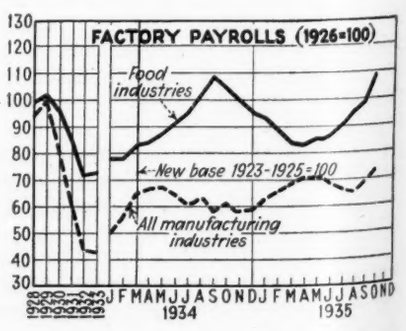
1934
1935


FACTORY PAYROLLS (1926=100)
Food industries
New base 1923-1925=100
All manufacturing industries
1928 1929 1930 1931 1932 1933
J F M A M J J A S O N D J F M A M J J A S O N D
1934
1935

Business Rise Continues

WITH STEEL production at the high point of the year, and other indices continuing to rise, business activity showed a further increase during November, in spite of the somewhat disappointing retail sales level of the first two weeks of the month. Between Oct. 19 and Nov. 16, the *Business Week* index rose from 67.4 to 68.9, a net increase of 2.2 per cent.

Prices of grain, flour, and meats have shown declines during the month, while butter and egg prices have risen rather sharply. Other commodity prices have changed little from previous levels. The U. S. Department of Labor index of wholesale prices of all commodities declined 0.37 per cent for the four weeks ending in mid-November, while farm products declined 2.14 per cent and food prices declined 0.82 per cent in the same period. For the four weeks ending Nov. 23, the New York *Journal of Commerce* index of general prices rose 0.86 per cent, with the grain price index down 2.67 per cent and the food price index up 1.67 per cent.

for some months. Livestock supplies, particularly hogs, have been greater than was anticipated, although still far below the normal figures for recent years, with hog supply the lightest in 57 years during October, and cattle receipts the smallest for the month since 1932. Also, consumer demand has continued low, so that, in spite of lower prices, and supplies somewhat larger than expected, total supplies available have had a tendency to pile up. With the advent of colder weather in November, demand increased somewhat, and prices, particularly of pork loins, again started upward. From the actions of the market, it is evident that retail prices are just at the critical point, so that resistance to any appreciable price increases is immediately evident.

For the long time pull, it is evident that meat supplies are now definitely on the increase. Reports indicate that cattle herds are now being increased, although it will be the latter part of 1936 before this has any appreciable effect on the number of cattle brought to market. Efforts to increase the hog supply and overcome the results of the drought and the AAA slaughter have borne fruit sooner than was expected. More hogs are reaching the market right along, and, though supplies will continue to be greatly curtailed throughout the winter, the Bureau of Agricultural Economics now looks for definite increases to begin next April. Meanwhile, the short supply will be somewhat offset by heavier weights.

Upturn in Sugar

BOTH American and European sugar consumption continues to increase, with figures up 4.5 per cent in this country for the first nine months of 1935, and up 3 per cent in Europe for the crop year ending Aug. 31. In the face of these increases, beet sugar production is off 8.3 per cent in Europe this year, while in the United States, beet sugar output is reported considerably below the quota for the year.

It is hard to see, however, how this increased use of sugar can cause any price advances other than speculative, in view of the potential over-production that always exists in sugar cane producing countries, unless such advance is caused by artificial restrictions in favor of domestic growers.

Sugar exports from the United States also continued on the upgrade, according to the reports of Lamborn & Co., which concern was also the scurce of the foregoing figures. For the first nine months of the current year these exports totaled 72,986 long tons, up 16,795 long tons, or 29.9 per cent, over the same period in 1934. These exports are the largest for the period since 1929, when the total was 80,014 long tons.

Construction News

	Pending (thousands)	Awarded November (thousands)	Total Awarded 1935 (thousands)
Bakery	$235	$148	$796
Beverages	344	198	4,750
Canning and Preserving	28	....	896
Confectionery	....	....	28
Grain Mill Products	1,019	60	1,414
Ice Manufactured	....	....	459
Meats and Meat Products	93	....	2,205
Milk Products	288	262	2,174
Miscellaneous	596	469	4,162
Total	$2,603	$1,137	$16,884

INDICATORS

KRAUT YIELD figures, as of Oct. 1, have been revised 2 per cent downward, to 156,690 tons, compared to 215,700 tons last year, and a five-year average of 154,100 tons.

PINEAPPLE and pineapple juice canning in Hawaii will be higher this year, as indicated by the production of 300,000,000 cans for that purpose by American Can Co.

SARDINE pack in Maine, this year, according to revised figures of the Maine Sardine Packers Association, will be just under 1,500,000 cases, compared to previous estimates of a 2,000,000 case pack.

GRAPEFRUIT and grapefruit juice pack in Florida during the present packing season will be smaller than usual, because of the short crop this year.

SNAP BEAN pack, estimated to be 7,500,000 cases in 1935, is about 23 per cent higher than the 1934 output, and 14 per cent over the five-year average.

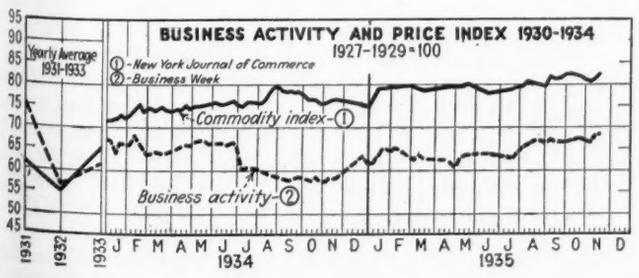
SWEET CORN pack for 1935 is now estimated at 21,000,000 cases, 71 per cent larger than the 1934 output, and 44 per cent larger than the five-year average.

DRY EDIBLE BEAN production in 1935 was the largest since 1930.

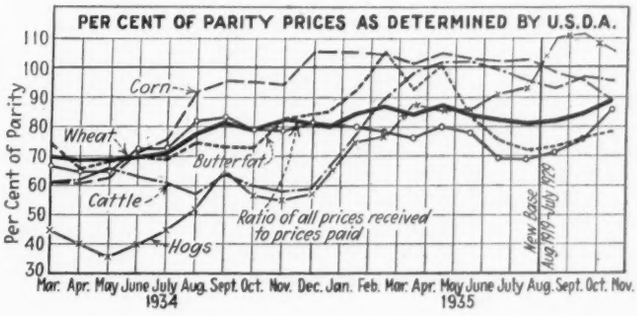
FRESH VEGETABLES are in ample supply for the coming winter season this year, with onions, cabbage, carrots, potatoes and sweet potatoes available in relatively large quantities.

NUT production, forecast at 107,000 tons for 1935, is considerably larger than the yield for past years.

COFFEE consumption in the United States has increased 30 per cent since 1915, according to the New York Coffee and Sugar Exchange.



BASIS FOR THE CURVES: Retail food prices, factory employment, factory payrolls and wholesale prices based on indexes of the Department of Labor. Cost of living index is that of the National Industrial Conference Board. Indexes of the per cent of parity prices are from the U. S. Department of Agriculture.



Things Have Happened

- ***Foodstuffs favored in trade treaty with Canada***
- ***Copeland Bill gets boost from New York City***
- ***FTC investigates millers by way of the mails***
- ***Hundreds suspected, 29 named, in brokerage case***
- ***Manufacturers discuss troubles; Bottlers meet***

Copeland Bill—Or Else

NEW YORK'S "exclamation point" mayor, fiery Fiorello H. La Guardia, has provided an incentive for early passage of the Copeland bill. He recently indicated that he would hold off until March further action on a proposed amendment to the New York Sanitary Code provided the drug, cosmetic and advertising interests objecting to the amendment work out proposals for federal regulation. This, in effect, means that they will have to get new food legislation through Congress before March or prepare for New York regulation which would literally compel manufacturers to submit national advertising to censorship by the city's board of health.

800 Packers Suspected

OPERATIONS of nearly 800 meat packers are being studied by the Department of Agriculture to determine whether others will be charged with violations of the Packers & Stockyards act in connection with sales to A. & P. The investigation also includes possible sales to other large buyers to determine if there has been illegal payment of brokerage fees. Late last month, charges had been filed against 29 firms.

Some packers have expressed "off the record" the opinion that the investigation may benefit the industry by ridding it of a vicious practice.

AGMA Hears—

BUSINESS need no longer feel any uncertainty as to what may come to pass in the future in the nature of governmental measures. That was the assuring message conveyed to manufacturers and distributors at the annual convention of Associated Grocery Manufacturers of America by Daniel C. Roper, Secretary of Commerce. "The basic program of reform has been completed," he said.

Another administration official, Secretary Wallace, spoke at this New York meeting last month. He outlined the need for pooling research on agricultural products and defended the AAA program. Stabilized production would benefit manufacturers and consumers alike, he said.

PAUL S. WILLIS
"We must show consumers . . . "

Paul S. Willis, who again was elected president of the association, told the manufacturers that their chief problem right now is costs. "Caught as we are in a flood of rising costs of raw materials, distribution, labor, equipment and marketing, we are bewildered to find ourselves assailed as profiteers. . . . We must show consumers now that our prices are fair! That instead of boosting prices we have lowered them," he said. Looking toward the future, Mr. Willis forecast an increase in the already apparent trend toward quality in foods.

Condemning the scramble for business at any cost, Thomas B. Terry, president, National-American Wholesale Grocers' Association, listed among the destructive trade practices, loss leader selling, quantity prices, advertising allowances and brokerage payments. H. C. Petersen, secretary-manager, National Association of Retail Grocers, condemned secret agreements and called for full information as to terms of sale, quantity discounts, brokerage and allowances.

Looking a century ahead, Laurence V. Burton, editor of FOOD INDUSTRIES, predicted that within 15 to 25 years the old South will produce all of its own dairy and pork products, about 50 per cent of its meat and all of its poultry and eggs. He also outlined other trends pointing to the South as a growing factor in food production and processing.

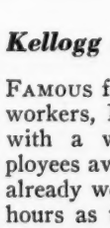
During the convention, AGMA honored Dr. Lafayette B. Mendel and Dr. Charles A. Browne.

Millers Investigated

THE Federal Trade Commission is conducting a broad investigation of the milling industry as the first step in its study of corporations handling agricultural products. Very voluminous questionnaires have been sent to thirteen leading milling companies. Questionnaires also have gone to tobacco manufacturers, and next in line are processors of cattle, calves, hogs and cotton. Not only does the milling questionnaire ask all manner of "personal" questions about operations and finances, but it requests names of important distributors and manufacturing consumers so that these in turn may be investigated. Millers are looking for a legal loophole by which they can avoid answering.

Xmas Reminder

TUBERCULOSIS is the greatest cause of death between the ages of 15 and 45, which makes it Public Enemy No. 1



Much is being done to combat this scourge by National Tuberculosis Association, and everyone purchasing Christmas Seals will do a public service.

Kellogg Raises Wages

FAMOUS for its six-hour day for factory workers, Kellogg Co. now comes along with a wage increase for male employees averaging 12.5 per cent. Women already were receiving as much for six-hours as they previously had for eight. This gives the company the highest wage scale in its history.

W. K. Kellogg, president and founder of the Battle Creek concern, believes the six-hour day with higher hourly wages is the only solution to the employment

problem. "We have found that with the shorter working day, the efficiency and morale of our employees are so increased, the accident and sickness rates so improved and the unit cost of production is so lowered that we can afford to pay as much for six hours' work as we formerly paid for eight," he says.

AAA Decision

LONG awaited by food manufacturers, a Supreme Court decision of the constitutionality of the AAA amendments likely will be forthcoming before the end of January, according to Washington observers. What was considered a severe blow to the AAA processing taxes came on Nov. 25 in the form of a Supreme Court decision awarding a temporary injunction against the collection of the processing tax on rice. This ruling, made in the case of the Louisiana rice millers, applies only to the tax on rice, but it is expected to result in action by other processors to halt the collection of practically all processing levies. The decision also strengthened the likelihood of adverse action by the Supreme Court on the constitutionality of the AAA program.

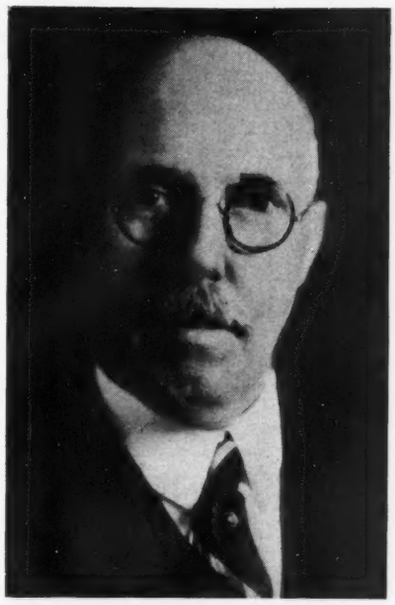
Bottlers Meet—Buy

MUCH interest in new equipment was shown at the Baltimore convention of American Bottlers of Carbonated Beverages last month. And the buying during the first two days indicated a sales volume more than double that at last year's show for some of the larger exhibitors. Syrup and extract manufacturers had happy smiles.

In machine design, the outstanding trend was the generous use of stainless steel, tinned bronze and other non-corroding metals for working parts and decorative trimmings. Also significant was the adoption of streamlined, sanitary, white-lacquered and enameled coverings for the bottle washers. Coil-type water-coolers were exhibited for first time.

The sessions of the short course in beverage technology took the form of technical service demonstrations in ingredient testing and product control. ABCB Technical Service Director John M. Sharf discussed carbonated and mineralized waters, citing the definitive difference for labeling purposes between natural and synthesized products.

George C. Calvert, Pfaudler Co., described the virtues of corrosion-resisting metals and glass-lined equipment for syrup making and emphasized the need for careful consideration of construction details when buying equipment for this purpose. Stating that yeast is responsible for probably 90 per cent of the spoilage in carbonated beverages, C. H. Hartman, St. Regis Paper Co., pointed out the protective features of the valve-type, multi-wall paper bag as a container for sugar used in making syrup.



DR. CHARLES A. BROWNE

Outstanding food chemist who, until his recent resignation, was assistant chief of the Bureau of Chemistry and Soils, has been honored by AGMA for service to food industry, as has Dr. Lafayette B. Mendel. He has done important work on fruit, butter and sugar. He is recognized for outstanding applications of science to the manufacture of foods.

Max Levine, Iowa State College, suggested that new bottle washing compounds be measured by the yardstick of 3 per cent alkali content, of which not less than 60 per cent is caustic, and the ability to clean a bottle satisfactorily in five minutes at a temperature of 130 deg. F. Compounds now in use give this performance at an approximate cost of 5 cents per 1,000 bottles.

The 1936 ABCB meeting is to be held in Minneapolis.

●

Conventions

DECEMBER

2-7—Fifteenth Exposition of Chemical Industries, Grand Central Palace, New York.
3—American Association of Creamery Butter Manufacturers, annual, Palmer House, Chicago. W. F. Jensen, 110 N. Franklin St., Chicago, secretary.
4-6—American Society of Refrigerating Engineers, annual, Hotel Pennsylvania, New York.
10-11—Tri-State Packers' Association, annual, Benjamin Franklin Hotel, Philadelphia.

JANUARY

13-18—American Fruit & Vegetable Shippers' Association, annual, Palmer House, Chicago. E. S. Briggs, 1425 S. Racine Ave., Chicago, manager.
19-25—National Canners' Association, National Food Brokers' Association, Canning Machinery & Supplies Association and machinery and supplies exhibit, annual, Stevens Hotel, Chicago.
22—National Pickle Packers' Association, annual, Palmer House, Chicago. F. D. Gorsline, 105 W. Adams St., Chicago, secretary.

Price Propaganda

PROCESSING TAXES and crop curtailment, not baker profiteering, put bread prices up. So say the bakers in New York State, and they are saying it with placards sloganizing, "Protest Roosevelt Bread Tax." Distributed by New York State Association of Manufacturing Retail Bakers to every retail bake shop in the state and to retail bakers' associations throughout the country, the eye-catching posters explain briefly the alleged effect of the AAA program on the consumer.

Spud Money—Maybe

"YES, we have no potato funds" seems still to be the refrain of Secretary Wallace. Emergency relief appropriations are not available for potato control, ruled the Comptroller General on Nov. 16. Funds totaling perhaps $25,000 however, may be spent from proceeds yet to come from the 45-cent potato tax. But tax returns for four months must first be estimated by Secretary Wallace, then approved by the Treasury and finally squeezed from money in the Treasury not otherwise appropriated.

Packaging Machine Show

CURRENT competitive conditions in the field of packaged foods require highly specialized packaging machinery, and to spread information on this phase of packaging, the series of conferences and clinics to be held in conjunction with the Packaging Exposition will include discussions on machinery. The exposition, to be in New York, March 3-6, also will include exhibits of eleven machinery manufacturers.

More Pigs—Less Corn

BY A two-year corn-hog control program announced last month by the AAA, there will be effected a 30 per cent increase in pork production next year. Too many pigs in 1937 will be guarded against, however. As for corn, there will be a downward adjustment of about 20 per cent in 1936 and of perhaps 25 per cent in 1937. Details are not yet complete.

Differ on Wine Rulings

DIFFERENCES of opinion have arisen among producers and importers of wine over regulations proposed by Federal Alcohol Administration. Domestic vintners do not like the ruling that they cannot use distinctive designations of specific wines such as Medoc, Bordeaux, Rouge, St. Julien and Chateau d'Yquem, but must employ generic names like Burgundy, Sauterne, Port, Sherry and Tokay. Importers, on the other hand, insist that this regulation be made effective. Nor does the proposed 18

per cent alchololic minimum please everybody. California vintners, with grapes high in sugar content, seek a higher minimum, while Eastern producers object to 18 per cent as being too high.

Would Crack Nut Agreement

CERTAIN nut houses in Oregon do not like the AAA walnut marketing agreement, and they have asked its dissolution. It is not needed to handle the surplus, and, besides, it is unconstitutional in that it illegally sets the price at which the surplus nuts must be turned over to the central board, they say. But if it were dropped, the price would slump some 8 cents, argue the growers.

Treaty With Canada

WHAT promises to be important trade concessions on several foodstuffs have been gained through the reciprocal treaty with Canada, which becomes effective Jan. 1. In the year ending March 1, 1930, Canada imported from the United States agricultural products valued at $49,778,000, but for 1935 that figure is only $15,195,000. With reduced tariffs under the treaty, much of this trade stands to be regained.

By the terms of the reciprocal pact, The United States and Canada grant to each other the most-favored-nation treatment and minimum tariff rates on every commodity.

Among the major specific concessions to the United States are widespread reductions on agricultural products, including fresh fruits, vegetables and wheat. Concessions to Canada include tariff reductions on cattle, calves, cream, live poultry, cheddar cheese, turnips, apples, maple sugar, halibut and minor fish supplementing the New England catch.

The accompanying tables list the concessions on foodstuffs made by the two nations:

Concessions to United States

	Present Duty to U. S.	New Duty To U.S.
Meats, prepared or preserved, other than canned, n.o.p.,* per lb.	6c	3c
Soya beans, n.o.p.	25%	Free
Indian corn for starch or such cereal products	Free	Free
Indian corn, n.o.p., bu.	25c	20c
Oatmeal and rolled oats, 100 lb.	80c	50c
Sweet potatoes, natural state, 100 lb.	15c	Free
Onions, natural state	30%	30%
Mushrooms, fresh	30%	15%
Vegetables, fresh, natural state		
Asparagus	30%	15%
Beans, green	30%	15%
Brussels sprouts	30%	15%
Cabbage	30%	15%
Carrots	30%	15%
Beets, n.o.p.	30%	15%
Cauliflower	30%	15%
Eggplant	30%	Free
Celery	30%	15%
Cucumbers	30%	15%
Lettuce	30%	15%
Parsley	30%	15%
Peas, green	30%	15%
Rhubarb	30%	15%
Spinach	30%	15%

DR. LAFAYETTE B. MENDEL

Famous scientist of Yale University gets AGMA honor, along with Dr. Charles A. Browne, for work on foods. He made fundamental investigations of proteins and vitamins, enriched the field of nutrition and otherwise contributed to the scientific knowledge of foods.

Tomatoes	30%	15%
Watercress and whitloof or endive	30%	15%
Peppers, green	30%	15%
Radishes	30%	15%
Artichokes	30%	Free
Horseradish	30%	Free
Okra	30%	Free
N.o.p.	30%	15%
Vegetables in air-tight containers		
Beans, prepared, lb.	3c	2c
Corn and tomatoes, lb.	3c	2c
Peas, lb.	3c	2c
N.o.p.	30%	27½%
Fruits, fresh, natural state		
Apricots	20%	15%
Cherries	20%	15%
Cranberries	20%	15%
Peaches	20%	15%
Pears	20%	15%
Plums or prunes	20%	15%
Strawberries	20%	15%
Raspberries and loganberries	20%	15%
Berries, edible, n.o.p.	20%	15%
Quinces and nectarines	20%	15%
Apples, fresh, natural state	20%	15%
Grapes, fresh, natural state, lb.	2c	1½c
Cantaloupes and muskmelons	20%	15%
Melons, n o p., each	3c	2½c
Fruits, fresh, natural state, n.o.p.	20%	15%
Advocados or alligator pears	20%	Free
Grapefruit, n.o.p., lb.	1c	½c
Oranges (during Jan., Feb., March and April) cu. ft.	35c	Free
Lemons	Free	Free
Olives, ripe, in brine, not bottled	30%	10%
Fruits, prepared, in air-tight containers		
Apricots, peaches and pears, lb.	5c	4c
Pineapples, lb.	5c	4c
N.o.p., lb.	5c	4c
Nuts, n.o.p., but not shelled peanuts, lb.	2c	1c
Nuts, shelled (n.o.p.,) but not shelled almonds, peanuts or walnuts, lb.	4c	2c
Halibut, fresh, pickled or salted, lb.	2c	1c
Lobsters, prepared or preserved	30%	Free
Shrimps in sealed containers	40%	27½%
Oysters, shelled, in bulk, gal.	10c	5c
Lobsters, fresh	25%	Free
Scallops, fresh but not frozen	25%	Free

*N.o.p. means not otherwise provided for.

Concessions to Canada

	Rates of Duty Old	New
Animal Products		
Cattle, per lb.	3c	2c
Calves, lb.	2½c	1½c
Cream, up to 1,500,000 gal. annually, gal.	56.6c	35c
Cheddar cheese, lb.	7c	5c
Live poultry, lb.	8c	4c
Chickens and guineas, dead, lb.	10c	6c
Vegetable Products		
Maple sugar, lb.	6c	4c
Cereal breakfast foods	20%	15%
Apples, bu.	25c	15c
Fresh strawberries, lb.	1½c	¾c
Blueberries, preserved or frozen	35%	25%
Cherries, lbs.	2c	1c
Peas, green: from July 1, to Sept. 30, lb.	3.9c	2c
Turnips and rutabagas, 100 lb.	25c	12½c
Fishery Products		
Fish, fresh or frozen		
Halibut, lb.	2c	1c
Salmon, lb.	2c	1½c
Swordfish, fresh, lb.	2c	1½c
Eels, lb.	1c	½c
Lake fish: Chubs, fresh water mullet, jacks, lake trout, suagers, tullibees, white fish and yellow pike, lb.	1c	½c
Fish, pickled or salted		
Salmon	25%	20%
Alewives (bulk), lb.	1½c	½c
Smoked herring		
Whole or beheaded, lb.	1½c	½c
Boned, lb.	3c	1½c
Razor clams, canned	23%	15%

Fishery Products on Free List

Sea herring and smelts, fresh or frozen; clams; quahaugs, fresh or frozen; crabs, fresh or frozen (not crab meat); oysters, fresh or frozen; lobsters, fresh, frozen or canned; scallops, fresh.

•

Concentrates

►NEW YORK State has been taken to task by the medical profession for advertising milk as a "patent medicine" . . . The skies will begin to clear for the meat industry by the end of 1936, Chicago packers believe. . . . Secretary Wallace is studying Boston and Philadelphia live-poultry markets to determine whether dealers there should be put under federal license.

►LOUISIANA oysters are often fattest and most palatable during the hottest days of summer, says James N. McConnell, of the state's conservation department. . . . Experiments are being conducted in the lower Rio Grande Valley in preserving and canning papayas, a tropical fruit. . . . Legislation barring sales of merchandise below cost is being sponsored in Louisiana by food retailers.

►DR. JOSHUA BERNHARDT, engaged in federal sugar activities for years, has been named chief of the sugar section of AAA. . . . Dr. Edward R. Weidlein, Mellon Institute head, is the recipient of the Chemical Industry Medal in recognition of applications of chemical research to industry. . . . Reports indicate the beginning of an organized campaign in the South against Wisconsin products to retaliate for that state's tax on oleomargarine.

►THAT a meat packing industry should be established in New Orleans is the recommendation growing out of an official survey. . . . "Matters of Procedure Under Government Contracts" is the title of a helpful booklet published by Fidelity & Deposit Co., of Maryland, Baltimore. . . . A limited number of tickets for the Exposition of Chemical Industries are available through FOOD INDUSTRIES.

Men . . . Jobs . . . and Companies

Industry

• ARMOUR & Co., Chicago, will double its research capacity with a new $300,000 laboratory to open this month.

• ARTIC DAIRY PRODUCTS Co., Lansing, Mich., will build a modern plant to cost $50,000.

• BOWEY'S, INC., Chicago, has acquired the Atkinson Chocolate Co. plant in Brooklyn, N. Y., where it will carry on manufacturing and warehousing operations.

• CHILI PRODUCTS Co. has been established at Detroit and will distribute throughout the Middlewest. Heading up the concern is Henry F. Schlenkert, formerly with Orange Crush Co. and Mexican Chili Co.

• CLEO BOTTLING Co., Miami, Fla., recently was bought by P. K. Beverages, Inc., and will be re-equipped.

• COCA-COLA BOTTLING Co. is constructing a modern factory at Spartanburg, S. C.

• DAI-LYQUID COFFEE CORP., manufacturer of concentrated liquid coffee and tea, has moved its plant from Milwaukee to Racine, Wis.

• DONAHUE-STRATTON Co. has merged with John Kellogg Co., Chicago, to form the Stratton Grain Co., with H. M. Stratton as president.

• GRAND TRAVERSE CHERRY SALES, INC., has been formed by five companies in the vicinity of Traverse City, Mich., including Crystal Canning Co., Glen Haven Canning Co., Traverse City Canning Co., F. & M. Canning Co. and John C. Morgan Co. The new organization will market its members' products.

• HILLSBORO-QUEEN ANNE COOPERATIVE CORP., Baltimore, recently purchased the plant of Fred Salad Dressing Co. at Bloomsburg, Pa.

• HOFFMAN BEVERAGE Co., Newark, has purchased a two-story brick factory in the same city.

• KRAFT-PHENIX CHEESE CORP. will construct immediately a one-story building in San Antonio to be used as a point of distribution in southwest Texas.

• LISTMAN MILLING Co., La Crosse, Wis., suffered a $100,000 loss when its plant was destroyed by fire Oct. 28.

• LYTLE Co., INC., has installed equipment in its plant at Gulfport, Miss., to manufacture puffed wheat, rice and corn.

• MARSHALL CANNING Co., Marshalltown, Iowa, has invested $150,000 in a new factory at Sugar Land, Tex.

• JOHN MORRELL & Co. reports that employee credit unions have been of great benefit to workers.

• PIONEER ICE CREAM BRANDS, INC., New York, recently reintroduced a 5-cent Charlotte Russe product.

• ROMA WINE Co., Lodi, Calif., has purchased Santa Lucia Winery, Fresno, increasing its capacity to 8,110,000 gal. of wine yearly. Roma takes over brands, labels and other possessions.

• SEABOARD PACKING Co., which has a fish cannery at Long Beach, Calif., has been bought by San Carlos Canning Co., Monterey, for $100,000.

• SHEFFIELD FARMS PRODUCTS Co. will build a $40,000 milk plant at Norwich, N. Y.

• SWIFT & Co. is building a $300,000 distributing plant in New Orleans to serve southern Louisiana and Central America. The plant, the largest Swift branch in the South, will be managed by L. C. McGee.

THOMAS MOORE

American Bottlers of Carbonated Beverages re-elected him president at the annual convention in Baltimore last month. He first took the office a year ago when he succeeded Martin L. Schmidt.

Personnel

• ROY E. BLACKBURN has purchased the interest of his partner, J. C. Henderson, in the Manchester (Ohio) Baking Co. and plans to install additional equipment.

• CHARLES F. BLISS, secretary of National Biscuit Co., New York, heads up the foods division of the United Hospital Campaign Committee.

• JOHN M. BORGER becomes Armour & Co.'s division superintendent at the Kansas City plant. James H. Walker goes to the Tiffin, Ga., plant, while Harvey W. Morsch has been transferred to Chicago as director of the research and budget departments.

• WARREN H. CLARKE, assistant to the president of Kroger Grocery & Baking Co., has been elected vice-president of Food and Chain Stores of America.

• CARL F. DIERKE has joined the Pacific Coast production staff of Kraft-Phenix Cheese Corp.

• H. L. FLYNN now is manager of the Chicago plant of Grennan Bakeries, Inc., and is succeeded at the Kansas City plant by Harold E. Jones.

• RUFUS E. HARRIS, for 39 years with Armour & Co., has retired as manager of the St. Paul branch.

• ERIC HAZEL, Atlanta, has been elected president of Georgia Bakers' Association, and E. F. Wright, of the same city, has been made first vice-president.

• L. E. KOPITZKE, Marion, heads up the Northeastern Wisconsin Cheese Makers' and Buttermakers' Association.

• H. R. LOCHRY, former assistant dairy manufacturing specialist in charge of Swiss cheese culture work in the Dover, Ohio, district, now becomes manager of a new government creamery at Beltsville, Md. Robert E. Hardwell succeeds him at Dover.

• JULIUS F. MULLER is establishing, at Baltimore, laboratories to manufacture soy bean and other pharmaceutical food specialties. He has resigned as chemist-bacteriologist with National Oil Products Co., Inc., Harrison, N. J.

• DR. H. A. MURRAY, JR., has been named chairman of the Niagara Frontier Section of American Association of Cereal Chemists.

• EDMOND OPLER, who resigned as president of E. & A. Opler, Inc., Chicago, has become vice-president and treasurer of Siren Mills Corp., Chicago.

• H. L. PERRIGO, Victor Flour Mills, Inc., Pittsford, N. Y., recently was re-elected president of New York State Millers' Association. Joseph W. Ward, William Hamilton and Sons Co., Caledonia, is again vice-president.

• PHILIP L. REED, for the past decade vice-president and treasurer of Armour & Co., Chicago, has been elected vice-chairman of the board of Winslow Bros. & Smith, Boston, an Armour-controlled organization. L. E. McCauley, assistant treasurer since 1925, succeeds him at Chicago.

• JAMES ROOSEVELT, son of the President, has resigned as president of National Grain Yeast Corp., Belleville, N. J. When he took the position July 1, he was to have an opportunity to buy a substantial interest in the company on Nov. 1, but large stockholders and officers of the corporation denied him the stock unless he spent more time in actual work for the concern.

• HERMAN A. ROSENBUSCH, Detroit, has been elected president of Master Brewers' Association of America to succeed Frank P. van de Westlaken.

• THOMAS A. SCOTT has been moved up from vice-president and general manager to president of Richmond (Va.) Dairy Co. to succeed the late J. O. Scott, and he continuues to serve as general manager. Mr. Scott also has been named head of Southern Cream and Milk Co., Richmond.

• WILLIAM C. TENCH, for ten years assistant general manager of Russell Miller Milling Co. and later an executive with Larabee Milling Co. and Anheuser-Busch, Inc., will do a jobbing business in flour, milk, eggs and bakers' specialties, with offices in Pittsburgh, Buffalo and Boston.

• L. C. TROYER succeeds W. G. Young as manager of the Salt Lake City branch of Swift & Co. Mr. Young has been placed in charge of the Seattle branch.

• HENRY VOGELMAN, who recently celebrated his 50th anniversary in the baking industry at the age of 75 years, has been made honorary president of Missouri State Bakers' Association.

• KING WEEMAN, Shawano Canning Co., heads up Wisconsin Canners' Association for the coming year, with J. L. Albright, Columbus Foods Corp., serving as vice-president.

JOSEPH A. FETHERSTON

He has taken a position with Novia Candy Co., Brooklyn, N. Y., as general manager in charge both of production and sales. He spent twelve years with Huyler's, during the last six of which he was production manager.

• JAMES C. WYMAN succeeds the late George K. Labatt as vice-president and general manager of St. Anthony & Dakota Elevator Co., Minneapolis.

Deaths

• JOSEPH ANTENUCCI, 40, for ten years a manufacturing baker at Providence, R. I., Nov. 2.

• JOSEPH A. ARCHBALD, 68, former treasurer of Collins Baking Co. and later director of General Baking Co. and vice-president of Ontario Biscuit Co., at Buffalo, Nov. 22.

• FRANK L. BEGGS, treasurer of Flavoring Extract Manufacturers' Association and a co-founder of Styron-Beggs Co., Newark, Ohio, recently.

• GEORGE D. BEROTH, 61, head of Beroth Bread Shops, Hartford, Conn., and past president of New England Bakers' Association, recently.

• CHARLES F. CARROON, 65, president of Carroon & Co., corn packer at Fowler, Ind., recently.

• FRANK J. GERRING, 61, an executive with Swift & Co. for 35 years, recently.

• OTIS E. GLIDDEN, 63, former president of Jiffy Dessert Co., Waukesha, Wis., and for many years manager of the Jell-O enterprises at Le Roy, N. Y., Oct. 20.

• DR. MAX HENIUS, head of Wahl-Henius Institute, Chicago, at Aalborg, Denmark, Nov. 15.

• EVERETT JACKSON, 58, retired director of Federal Sugar Co., at Plainfield, N. J., Oct. 24.

• DAVID KIRK, JR., 54, director of Kirk Milling Co. and general manager of a wholesale grocery concern, at Findlay, Ohio, Nov. 4.

• T. J. LAPRES, 68, pioneer salt-water-taffy manufacturer of Atlantic City, N. J., Oct. 29.

• ROY A. LUSK, 64, president of Lusk Mustard Co., New York, Nov. 18.

• E. P. OWEN, a veteran operative miller with Ponca City (Okla.) Milling Co., recently.

• ALFRED P. WALKER, 71, former president of Standard Milling Co. and a director of many milling concerns, at Pelham Manor, N. Y., recently.

• HOWARD B. WARD, 55, former general production manager and for many years a director of Ward Baking Co., at New Rochelle, N. Y., Nov. 20.

Associated Industries

• AUTOMATIC SCALE CO., INC., is the new name of Scale & Machinery, Inc., New York, the name having been changed to make it more descriptive of the company's business.

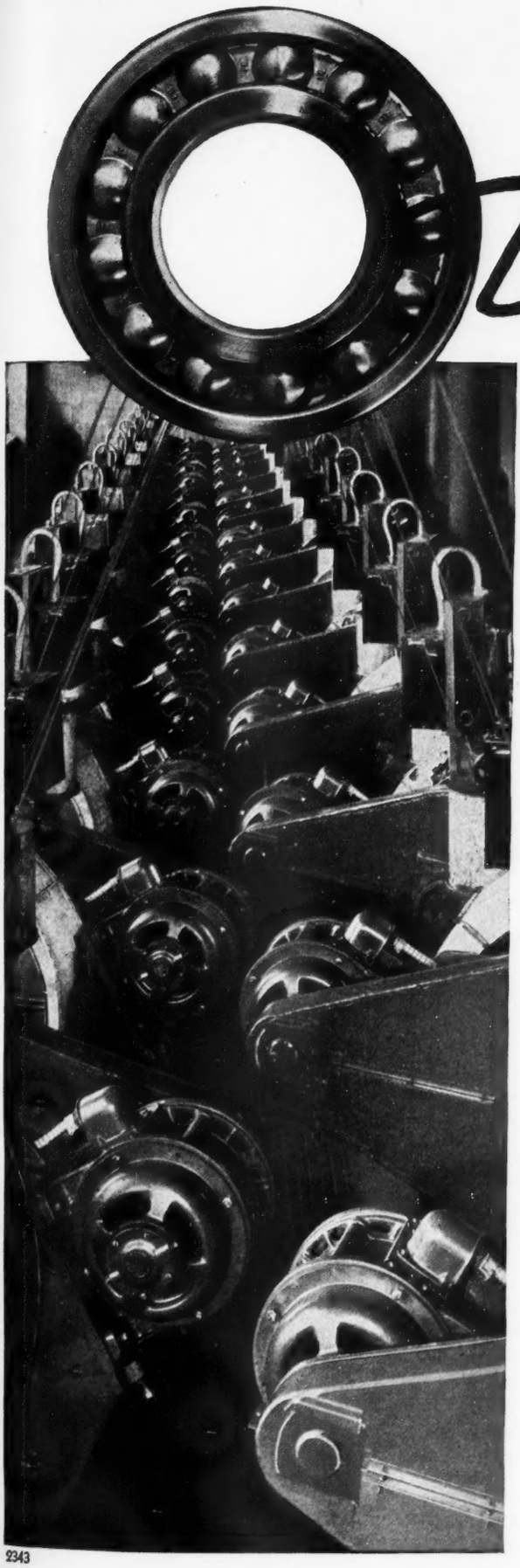
• FOUR WHEEL DRIVE AUTO CO. has appointed H. M. Daniels supervisor of the new consolidated Eastern sales division and made A. F. Waterland manager of the recently established Philadelphia branch.

• HANCOCK VALVE DIVISION of Consolidated Ashcroft Hancock Co., Inc., has appointed new stock carrying jobbers in St. Louis, Tulsa, Cambridge, Pittsburgh, Milwaukee, Los Angeles, Chicago, Tampa, Portland, Atlanta, Amarillo, Long Island City, Savannah, Brooklyn, Omaha, St. Paul, and Evansville.

• KELLOGG SERVICE, INC., New York, has been organized by Burton G. Kellogg to serve food manufacturers by testing products and by handling merchandising problems.

• READ MACHINERY CO., INC., has placed E. D. Davis in the Oklahoma territory to handle bakery equipment.

• REPUBLIC STEEL CORP. has made George E. Clifford district sales manager at Los Angeles.



BALL BEARINGS *Did things* TO THE ELECTRIC MOTOR

THEY cut time and cost of lubrication—using grease at one or two year intervals.

They eliminated thrust load problems—being the most efficient thrust carriers known.

Then, with thrust taken care of and leakage prevented by non-fluid lubricant, a motor could be mounted in any position from horizontal to vertical without shifting the end bells.

Many thousands of motors with New Departure Ball Bearings have demonstrated for years that ball bearing dependability, accurate support and long life make them the logical choice, where profits must be assured by low maintenance and operating costs.

The New Departure Mfg. Company, Bristol, Conn. Sales and Engineering Branches at Detroit, Chicago, San Francisco, London.

New Departure also makes the Variable Speed Transitorq.

Nothing Rolls like a Ball

2343

« NEW DEPARTURE »

"Trees die from the top"

—*and so do advertising agencies*

WHEN executives grow old, there is danger that the business may grow old with them. Every business faces this problem.

For the Life Span of a business tends to follow the Life Span of its management.

Even when executives remain physically and mentally fit, there comes an inevitable "hardening" of their outlook.

The management becomes conservative, old-fashioned, definitely "set" in its ways.

It loses the priceless *ability to create new ideas conforming to changed conditions*. Unless great forethought is exercised, business and management decline together.

For businesses, like trees, often die at the top—and none more quickly than personal services such as advertising agencies.

The Business is an "Organism"

The answer, of course, is "new blood." To avoid hardening of the corporate arteries, younger men must be taken in.

They must bring vigorous energy and new insight into the organization. Only by investing in youth can a business keep from "acting its age."

We of Lord & Thomas have had long experience in this art of keeping young.

We have learned to mold the business into a living organism that constantly renews itself, yet always maintains its fundamental qualities.

This requires a statesmanship that balances the experience of management with youth's eager brilliance.

Youth Reaches Upward

In our offices, all barriers are removed from the path of talented youth. The able ones climb high and fast.

Lord & Thomas are unique in being a seasoned and immensely successful business, conducted almost entirely by men who can still touch the floor without bending their knees.

Today, they sit in our highest councils.

The average age of our top executives is 37 years, the oldest being 55, the youngest, 30. The length of service ranges from 1 year to 38 years.

These men came as recruits from many fields. Several have risen to high position from the groups of college men whom we select yearly.

Two outstanding writers came to Lord & Thomas seeking larger opportunities, after winning early distinction as writers of advertising.

One executive shone as a brilliant sales manager in the grocery field—another in drugs.

Still another won recognition in the publishing field for his ability to develop powerful merchandising tie-ups with national advertising.

From Roots to Topmost Branch

Not only in the executive groups, but at every level of our organization, these fresh talents and viewpoints are constantly being merged with the generalship and experience of older men.

In this way Lord & Thomas maintain our fundamental character—our devotion to basic principles of Salesmanship-in-Print. And remain ever a young organism—alert, courageous and aggressive.

In our 63 years of existence, we have invested $500,000,000 for clients in advertising. And more than one-third of that amount, *$180,000,000—has been placed in the past five years of depression.* We are old and experienced in the art of keeping young.

LORD & THOMAS · *advertising*

There are Lord & Thomas offices in New York; Chicago; Los Angeles; San Francisco; Toronto; Paris; London. Each office is a complete advertising agency, self-contained; collaborating with other Lord & Thomas offices to the client's interest

HOW Firestone TIRES CUT DELIVERY COSTS

WIDER, FLATTER TREAD WITH MORE RUBBER ON THE ROAD Gives Greater Mileage
TWO EXTRA LAYERS OF Gum Dipped CORDS UNDER THE TREAD Locks it to Body
Gum Dipped CORD BODY Prevents Internal Friction and Heat

CERTAIN construction features must be built into tires to give you greatest safety and lowest cost in delivery service.

To make Firestone Tires blowout-proof, the cord body is built up of Gum-Dipped cords. To give you greatest non-skid safety and long mileage, the Firestone tread is scientifically designed, with a flatter contour and more rubber on the road. There are two extra layers of Gum-Dipped cords, to lock the rugged tread securely to the Gum-Dipped cord body.

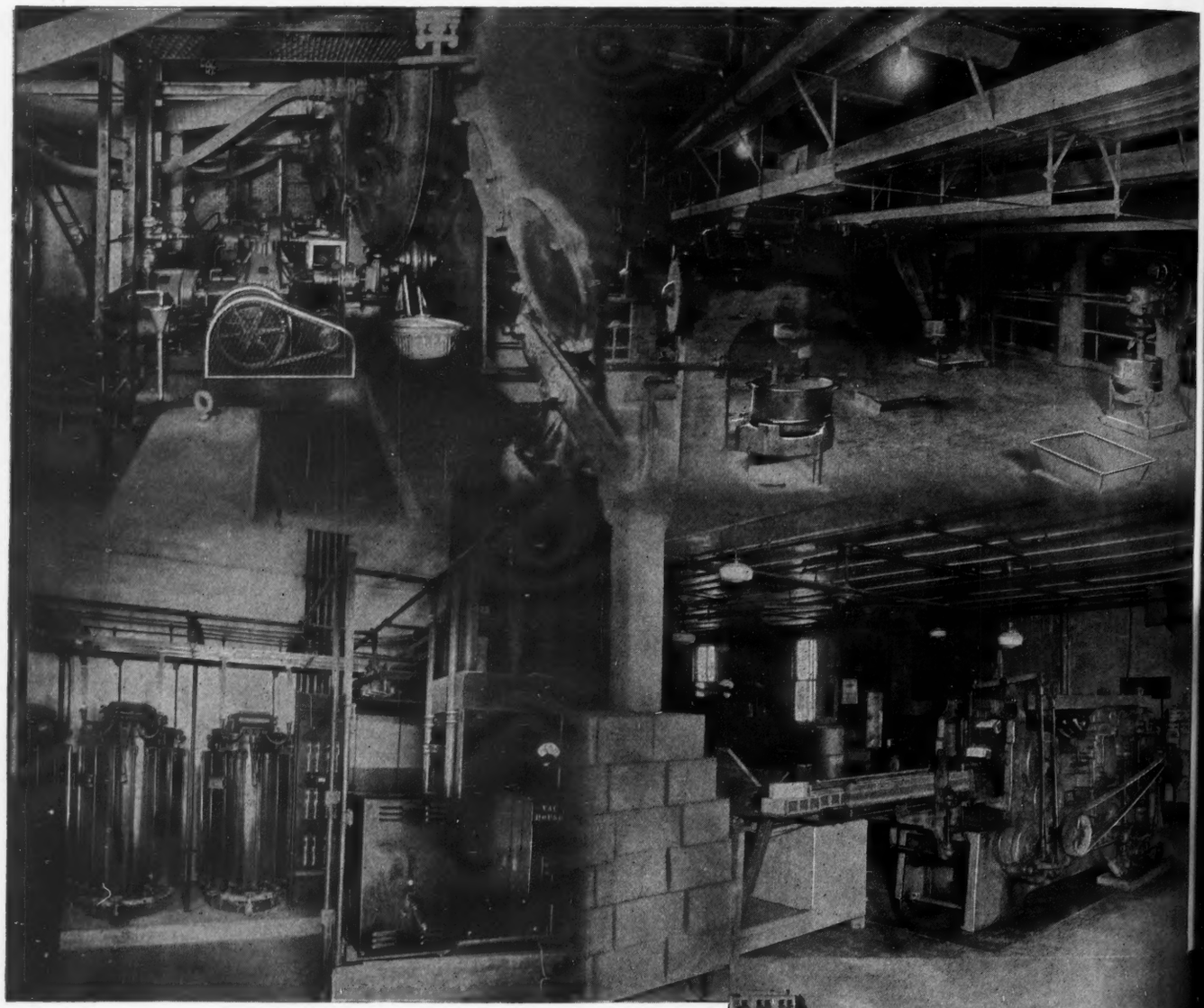
Firestone Truck Tires are the only tires made that give you all these exclusive advantages.

Equip your trucks with Firestone Tires and start cutting your operating cost today. The nearby Firestone Auto Supply and Service Store or Firestone Tire Dealer is ready to serve you.

Listen to the Voice of Firestone—featuring Richard Crooks, Nelson Eddy—with Margaret Speaks, Monday evenings over Nationwide N. B. C.—WEAF Network

© 1935, F. T. & R. Co.

HOW YOU PROFIT B



Pyranol capacitors for power-factor improvement
Generating and voltage-regulating equipment, switchboards, switchgear, electric cable — in fact, everything electric for your plant.

FOR EVERY TYPE OF PLANT—EQUIPMENT FOR ALL ELECTRICAL REQUIREMENTS

General Electric offers to the food industries a complete line of electric equipment, well-engineered and well-manufactured to give you the benefits of high electrical efficiency and long, trouble-free service:

Motors and control designed for every service
Gear-motors for efficient, low-speed drives
Electric heating units and devices
Photoelectric relays for packaging and sorting
Thrustors for remote operation of brakes, etc.

BY G-E RESEARCH

Out of This Research Come Progress and Profits

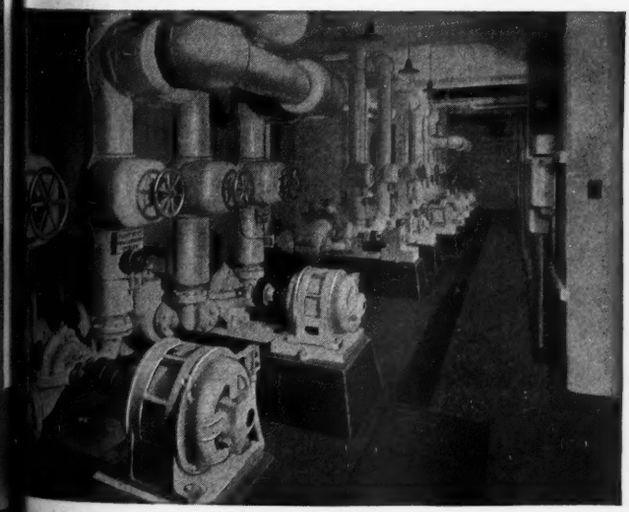
THE photoelectric tube—a sensitive "electric eye" made practical by G-E research — is being used more and more by the food industries for such applications as high-speed sorters and accurate register and cutting control for modern packaging machinery.

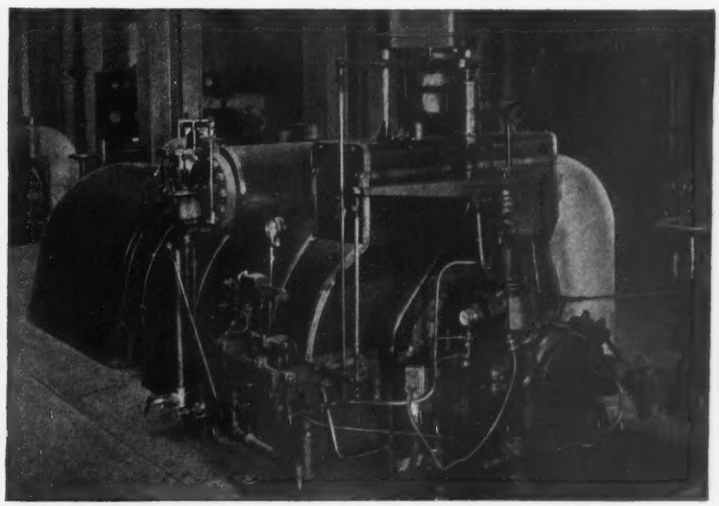
Metal detectors, which locate even the smallest pieces of "tramp iron" in packaged foods as they move along the shipping line, are also a product of G-E research.

Micalex and other insulating materials developed by General Electric have reduced insulation failures to a point where electrical trouble is now an insignificant part of the plant-maintenance budget. Motor bearings require less maintenance as a result of studies on lubrication and bearing materials.

Silicon steel—an important factor in present-day high motor and transformer efficiencies — was made practical for electrical use by G-E research in co-operation with the steel industry.

Continual developments and laboratory investigations, combined with General Electric's 40 years of manufacturing experience, are your assurance that you get the latest and best when you buy G-E equipment. No matter what your electrical needs may be, it will pay you to consult our nearest sales office, or General Electric, Schenectady, N. Y.





011-98

GENERAL ELECTRIC

MODERN designs in glass containers need attractive closures to supply the final touch of trim, distinctive appearance. And no matter what type of food product the package contains, it must be thoroughly protected by a sure-sealing cap. Full flavor and quality must be intact when the consumer opens the glass container.

Armstrong's Metal Caps will harmonize with the design and color scheme of your food container—make your package look neat and pleasing to the eye. And you can *depend* upon an Armstrong's Metal Cap to provide a snug, secure seal. The sealing ring on the top of each Armstrong's Cap presses the liner tight against the glass finish to fully protect the quality of your product.

From your factory to the consumer's home, Armstrong's Metal Caps will protect your product and give your package additional eye-appeal. They will do their part in helping to win more sales and repeat sales . . . increasing the dividends on your packaging investment.

For full information and samples, write to Armstrong Cork Products Company, Closure Division, 919 Arch St., Lancaster, Pennsylvania.

Armstrong's

METAL CAPS

CLINTON COTTON MILLS, Clinton, S. C. Weave Shed
finished with S-W Save-Lite Undercoater and Gloss White
put your WALLS and CEILINGS to work . .
• Ceiling and wall surfaces are actually a part of your lighting system. But they must be white and stay white to reflect all the available light and return the most for every dollar invested.
In every way SAVE-LITE is the Plant Conditioning Paint because of its:
1. Initial whiteness
2. Color retention
3. Unusual opacity
4. Good spreading
5. Easy application
6. Proper drying
7. Dirt-resistance
8. Washability
9. Resistance to special conditions
10. Durability
11. Economy
SHERWIN-WILLIAMS
SAVE-LITE
THE PLANT CONDITIONING PAINT
COVER THE EARTH
SWP

NEW
ALUMINUM
TRIMMING POT

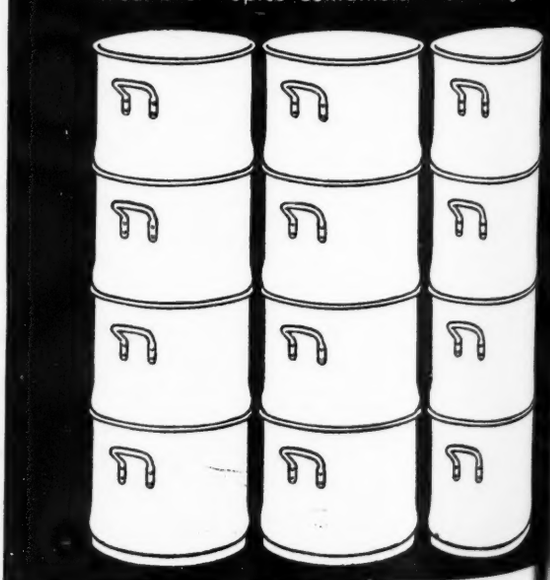
MODERATELY PRICED

● This silvery pot is made of a new Aluminum alloy. It will never need tinning. It can't rust. The gleaming purity of the Aluminum cannot wear off. Being seamless, it is easily kept immaculate. Neither meat nor fruit acids can affect it. Tell us your requirements and let us send you a quotation.

"Wear-Ever" offers you everything in Aluminum for modern, sanitary packing and canning plant needs. This name on your equipment is assurance that each item is made of the Alcoa Aluminum alloy best suited to give longest, most economical life in the use for which it is intended. For complete catalog of "Wear-Ever" Aluminum equipment, address THE ALUMINUM COOKING UTENSIL COMPANY, Desk L-400, 11th St., New Kensington, Pennsylvania.

WEAR-EVER ALUMINUM TRADE MARK REG. U.S. PAT. OFF.

"Wear-Ever" Spice Containers — Stacking Type



ALUMINUM—THE FOOD-FRIENDLY METAL

"Wear-Ever" ALUMINUM

THE STANDARD: WROUGHT OF EXTRA HARD, THICK ALUMINUM PLATE

Here's

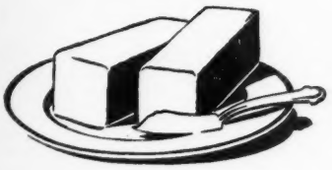
MORE BUTTER

for your bread

Raw material plus heat equals bread.

Obviously raw materials constitute the most important factor in the baker's business life . . and that being so, you must, at this writing, be approaching the ultimate in this department. In other words, a ten percent saving here would hardly be possible . . would it?

But heat . . that's another pan of rolls. Not to beat around the bush, Kemp firing with 100 percent *premixed* gas and air from the Industrial Carburetor does save what is often called *dough.* To be technical, bakers' savings on fuel run from 15 to 50 percent with Kemp equipment. And, if you like, F. H. A. will finance the job on a modernizing loan.



Shall we
PASS IT?

Perhaps we should tell you more? Write The C. M. Kemp Manufacturing Company, 405 East Oliver Street, Baltimore, Maryland.

KEMP of BALTIMORE

"Just Around the Corner"

AMERICA'S INDUSTRIES FIND CRANE STOCKS

● Crane service in valves, fittings, and piping is a *localized* service. Within 24 hours of every factory in the United States, and within one to two hours of a great majority of them, complete stocks of Crane valves and fittings are available.

The Crane line is extensive, capable of answering the daily requirements of the 209,348 industrial establishments within the service areas where Crane stocks are carried.

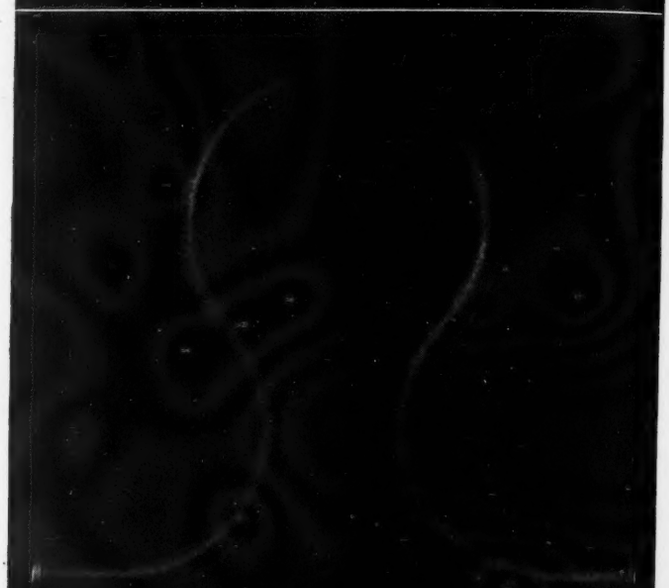
Crane materials will help you solve any piping problem. If extensive modernization is contemplated, the Crane Finance Plan allows you to spread the cost over a period of years.

CRANE SHOP FABRICATION SERVICE

Design — Flanging
Casting — Cutting
Bending — Threading
Welding — Assembling

There is a Crane Valve or Fitting for every piping requirement

INTEGRATED PIPING



Crane Expansion Pipe Bend

1 Just one item in the Crane line of complete pipe fabrication services.

2 Crane pipe bends will fit exactly into their place in your piping—specially built machinery assures this.

3 Connecting ends of bends may be threaded, beveled for welding, flanged and refaced or Cranelapped for Vanstone joint.

4 Crane eliminates wasteful and inconvenient divisions of responsibility by centering pipe fabrication in one organization with valve and fitting manufacture.

CRANE

CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVE., CHICAGO, ILLINOIS • NEW YORK: 23 W. 44TH ST.

Branches and Sales Offices in One Hundred and Sixty Cities

CRANE VALVES, FITTINGS AND PIPE FABRICATION

Slight Adjustments can change the whole picture

The camera was out of focus in this shot. A very slight adjustment produced the clear, sharp photo at the right. Motors can get "out of focus" too—and then fuel expenses skyrocket.

When Timing is "Out of Focus"...

YOUR FLEET WASTES GAS

THE smallest errors in ignition timing mean gasoline robbery. *And the distributor is just one of the 16 vital spots under every hood in your fleet where "out of focus" operation causes fuel waste.* Slight adjustments can change the whole picture; and differences in fuels and lubricants used can effect bigger savings than the differences that exist in prices.

Standard Oil (Indiana) combustion engineers are saving money for many fleets. They make a *thorough* check-up and recommend the adjustments necessary to gain maximum economy. *And they do it without obligation.*

You will profit by using this service. Challenge these men to produce lower costs per mile for you. Do it today—and watch your fleet operating costs drop to new lows. Call your nearest Standard Oil (Indiana) office—get your operating costs back in focus now.

STANDARD OIL COMPANY (*INDIANA*)

910 SOUTH MICHIGAN AVENUE • CHICAGO, ILL.

STANDARD OIL PRODUCTS: ISO-VIS "D" • Polarine Transmission Oil (Summer and Winter Grades) • Polarine Heavy Duty Gear Grease • Polarine Wheel Bearing Grease (Medium and Heavy) • Polarine Fibre Grease (for Universals) • Polarine Pressure Gun (Medium and Heavy) • Polarine Water Pump Grease • Polarine Steering Gear Lubricant.

STANDARD OIL COMPANY (INDIANA) SERVICE

Copr. 1935, Standard Oil Co.

STANDARD OIL SERVICE

WAYS TO REDUCE OPERATING COSTS . . . WAYS TO RE

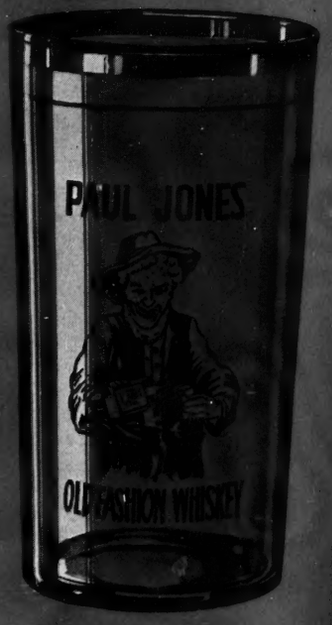
MACBETH

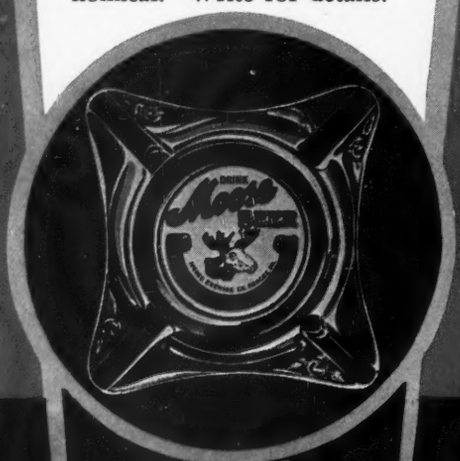
Trade-marked TUMBLERS

★

Shur-Out ASH TRAYS

Macbeth Tumblers, with popular "Chip-Proof" edge or plain shell type, with or without platinum or gold rims, are available, in all standard sizes, with your name, trademark or any desired decoration permanently applied on each glass in your choice of colors. They fill the last gap between the producer and consumer and discourage substitution of inferior brands. • "Shur-Out" Ash Trays are effective little advertisers, welcomed by restaurant owners because they prevent scorched table cloths and burned table tops. Cigarettes cannot possibly burn past the magic safety circle. Available with any desired design or colors. • Prices are economical. Write for details.





MACBETH-EVANS
GLASS COMPANY
Charleroi, Penna.

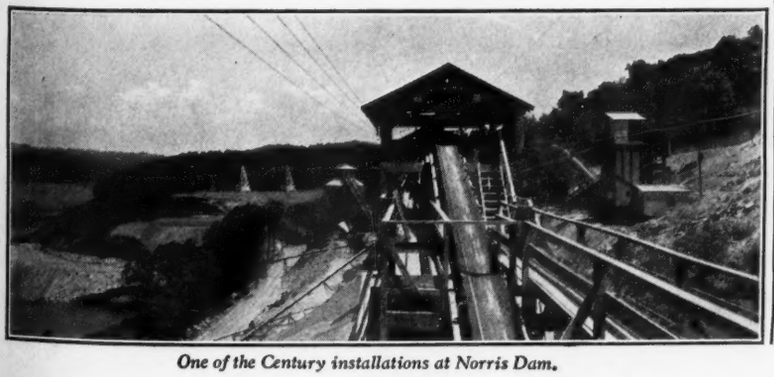
CENTURY SQUIRREL CAGE INDUCTION MOTORS

UP TO 600 *Horsepower*

ON particularly tough, dirty, wet jobs you will find Century Motors setting a record of continuously satisfactory performance! This statement stands on more than 30 years' proof! It is your safeguard in the selection of motors for driving your product or plant equipment — no matter what it is — no matter what severe demands are imposed upon it!

Here's more proof that Century can do a job for you:

T·V·A· *and* CENTURY



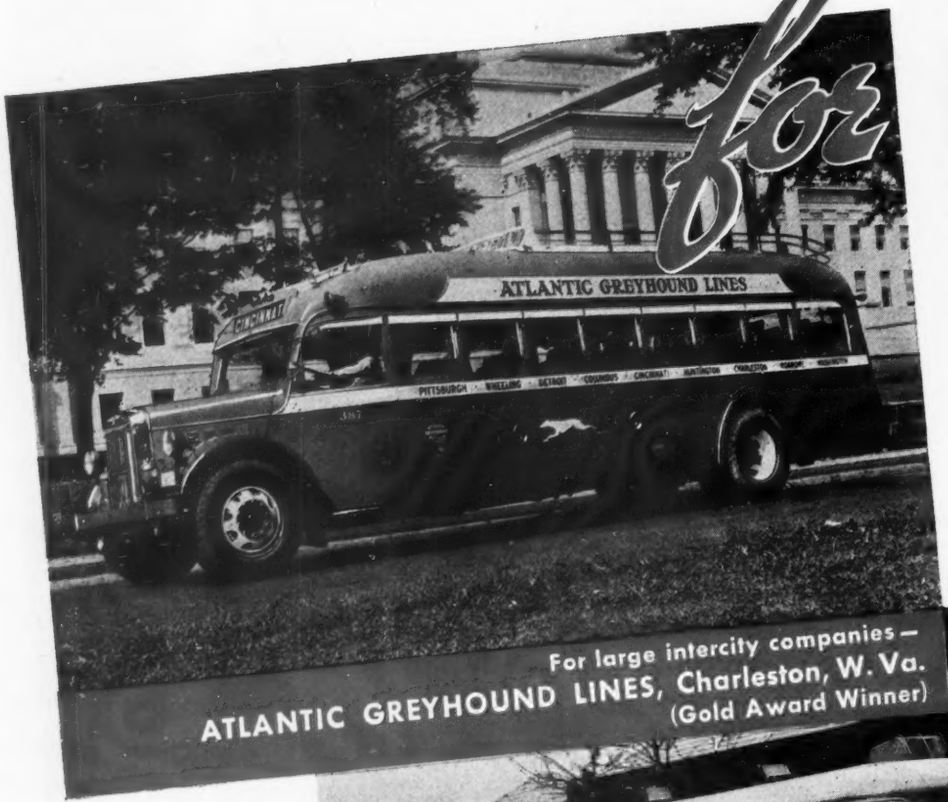
One of the Century installations at Norris Dam.

For Materials-handling Equipment Century Motors are engaged in the dirtiest, toughest kind of service — many of them exposed to the elements — driving Rock Crushers, Gravel and Rock Screens, Conveyors and similar equipment . . .

CENTURY ELECTRIC COMPANY
1806 Pine Street , , St. Louis, Mo.
Offices and Stock Points in Principal Cities

Century MOTORS

WIN MAINTENANCE *for 6th*



For large intercity companies—
ATLANTIC GREYHOUND LINES, Charleston, W. Va.
(Gold Award Winner)

For large city companies—
MOTOR TRANSIT COMPANY, Jacksonville, Fla.
(Silver Award Winner)

TEXACO
REG. T. M.

AWARDS

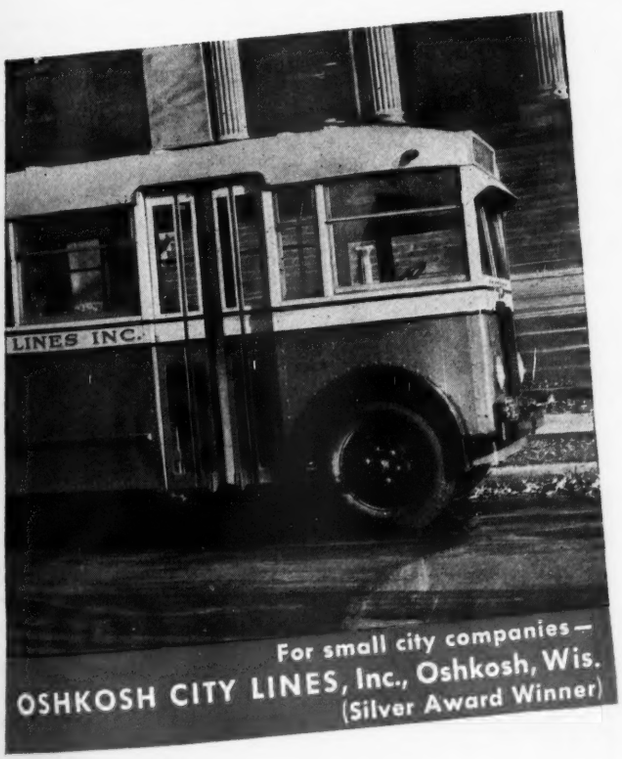
consecutive year!

When fleet owners . . using the same lubricants . . slash operating costs . . year after year . . that's *NEWS*

Each year, all over the country, alert fleet managers, service executives and mechanics are bending every effort to improve operating schedules while reducing costs.

They do this, not just to win a possible award in the annual "Bus Transportation Contest" but for their own dollars-and-cents benefit. Every year—six times straight—since this contest started, Awards in it have gone to users of Texaco Products.

And this year, Texaco users not only won the Gold Award, but two additional Silver Awards. Moreover, *every* Gold Award in this contest has gone to a Texaco user.



For small city companies—
OSHKOSH CITY LINES, Inc., Oshkosh, Wis.
(Silver Award Winner)

How well these passenger-carrying fleet operators rate Texaco is evidenced by the fact that *more bus-miles are operated with Texaco than with any other brand.*

Fleet operators, whether carrying people or products, have similar maintenance problems. You, too, can benefit from the proven economy gained by using Texaco Products in lowering your maintenance costs and improving the dependability of your equipment.

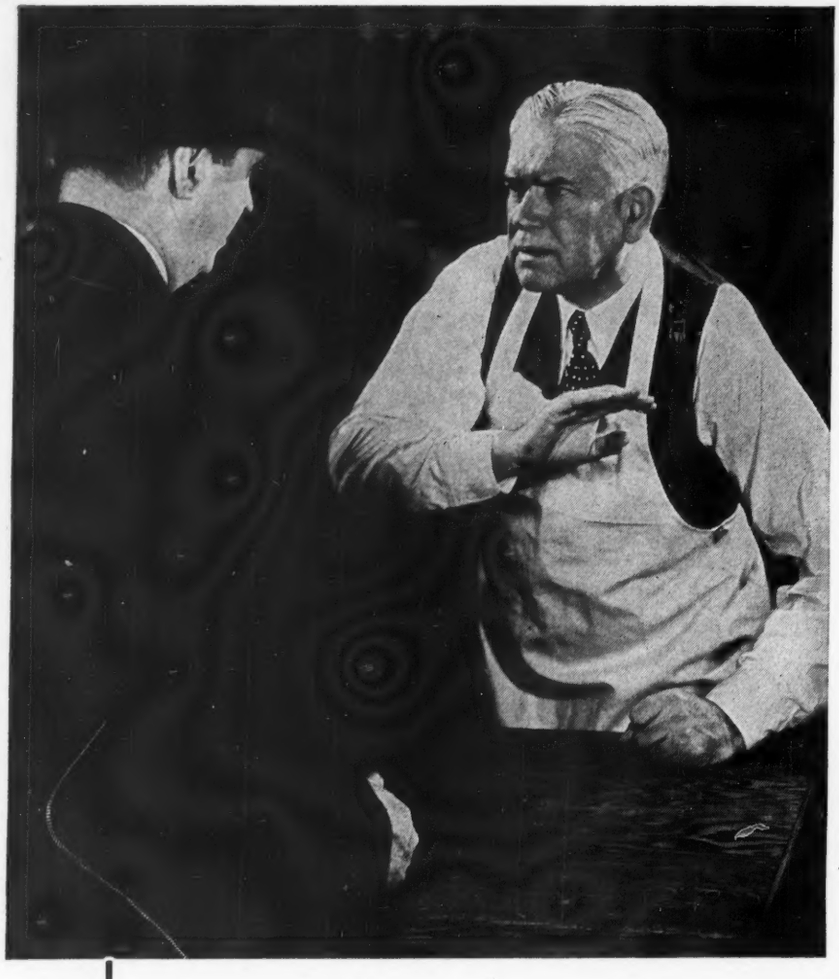
Texaco Products are backed by a technical service that cooperates with your men, analyzing the needs of each fleet operation in selecting the right lubricants for the crankcase, gears and bearings. Call in the Texaco representative.

THE TEXAS COMPANY

135 East 42nd Street · New York City

Nation-wide distribution facilities assure prompt delivery

TEXACO PRODUCTS



TURNOVER! Say—the only turnover your product gets is when we dust it!

Discouraging? Yes. But more important, it is a signal that something is probably wrong at the point of sale.

If this happens in the merchandising of your product, has it occurred to you that we might be able to help you find out the reason why?

We have practically grown up with package merchandising. We have seen many problems solved and had a share in their solving. This accumulated experience is yours without obligation. But if yours is a new problem, you will find us ready and willing to work with you in solving it.

A letter to us may help you solve your problem. Address the Sales Promotion Department of the American Can Company, 230 Park Avenue, New York City.

AMERICAN CAN COMPANY
230 Park Avenue, New York

Listen to
BEN BERNIE
"and all the lads"
TUESDAY NIGHT
N.B.C. WJZ NETWORK
9 P.M., E.S.T.

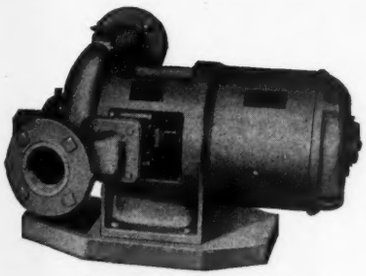
JENNINGS VACUUM HEATING PUMP

Vapor Turbine type above requires no electric current. Efficiently handles air and condensate from return line heating system, promoting high operating efficiency.

JENNINGS SUMP & SEWAGE PUMPS

PEDESTAL TYPE

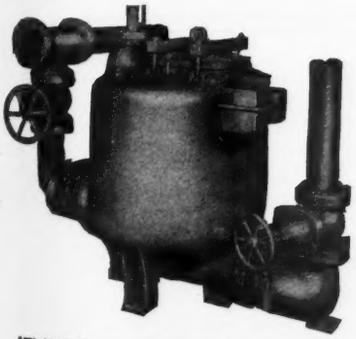
Mounted entirely above the pit cover. Entirely self-priming. All working parts high and dry. Only suction pipe submerged. Economical.



CENTRIFUGAL PUMPS

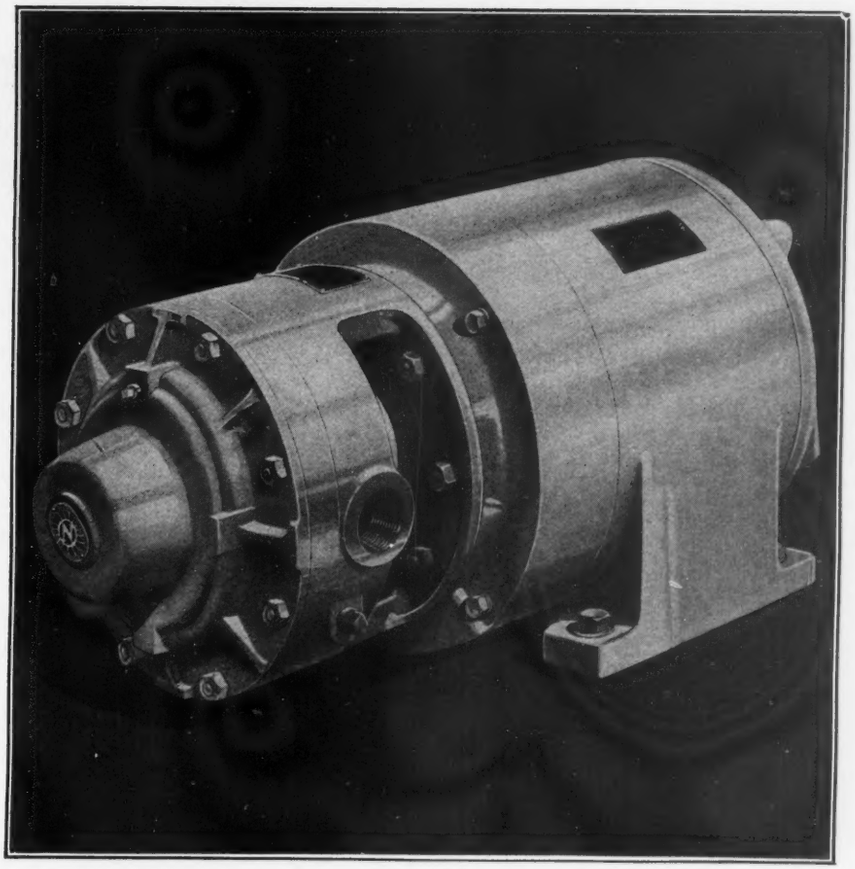
STANDARD AND SELF-PRIMING

Motor armature and pump impeller mounted on same shaft. No bearings in pump casing. One stuffing box. Simple, compact, reliable.



JENNINGS SEWAGE EJECTOR

Most efficient device for pumping unscreened sewage from low levels, or pumping any heavy liquid with large proportions of solids.



There Is a Nash Unit for Every Pumping Service

There is a reason for the many thousands of installations of Nash Pumps. For over twenty years the name Nash has stood for reliability in pumping equipment. From the complete Nash line it is possible to select a superior pump for practically any service.

One of the newer members of the Nash Pump family is the Nash MD Compressor shown above. This pump is especially suitable for the chemical, and foodstuffs field. Only clean air free from dust, heat, or oil, can be delivered for it has no parts in metallic contact, and no internal lubrication. This is important in agitating, blending, moving liquids by pressure displacement, or for maintaining pressure on storage tanks.

This unit furnishes a reliable, non-pulsating supply of clean air at pressures up to 75 lbs. Built integral with its driving motor, it is extremely compact. The unit may be installed anywhere. We have an instructive bulletin telling all about Nash Pumps. Why not get your copy?

NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

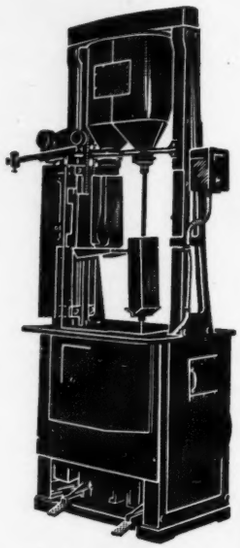
See them in

Action

While attending the Chemical Exposition be sure to see these two notable Stokes & Smith Filling Machines in actual operation. The Universal Filler is for powders, granulars or pastes in quantities from ½ ounce to five pounds. The Duplex Packer and Weigher employs a different method of filling the same materials in quantities up to 25 pounds. If you cannot attend the Exposition, write for descriptive literature.

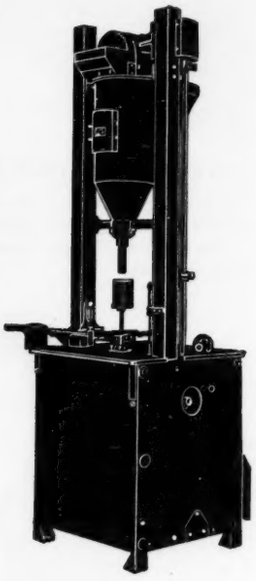
Booth 265

15th Exposition of Chemical Industries
Grand Central Palace, N. Y. C.
December 2 7



S & S DUPLEX PACKER AND WEIGHER

S & S UNIVERSAL FILLER



STOKES & SMITH Co

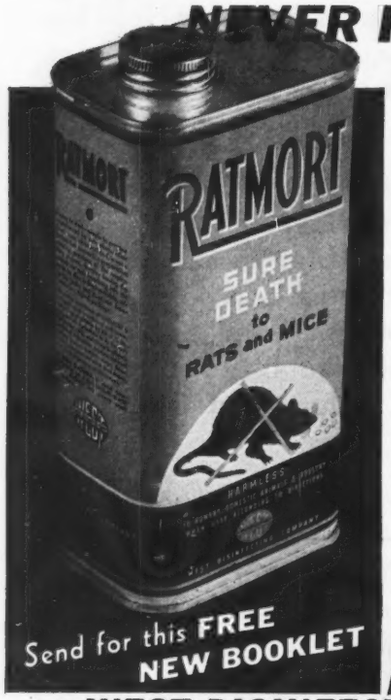
PACKAGING MACHINERY — PAPER BOX MACHINERY

4911 Summerdale Ave., Philadelphia, U. S. A.

FILLING MACHINES · · CARTON FILLING AND SEALING MACHINES · · BAG AND ENVELOPE FILLERS AND SEALERS · · TIGHT-WRAPPING MACHINES · · COMPLETE PACKAGING LINES

RESULTS

NEVER POSSIBLE BEFORE!



Send for this FREE NEW BOOKLET

Rats can not live if they nibble only a small part of RATMORT bait. RATMORT causes rodents to rush outside for air, eliminating the danger of decaying carcasses on the premises.

RATMORT, harmless to humans and domestic animals, is a concentrated extract of red squill, which is approved and recommended by the U. S. Dept. of Agriculture. Its use is officially permitted in dairies, groceries and other food depots.

WEST DISINFECTING CO.

42-16 BARN ST., LONG ISLAND CITY, N.Y. *Branches in Principal Cities*

Leading manufacturer of insecticides and disinfectants for half a century.
Write us for advice on your particular problem.

AMERICAN

— COKE —

TIN PLATE

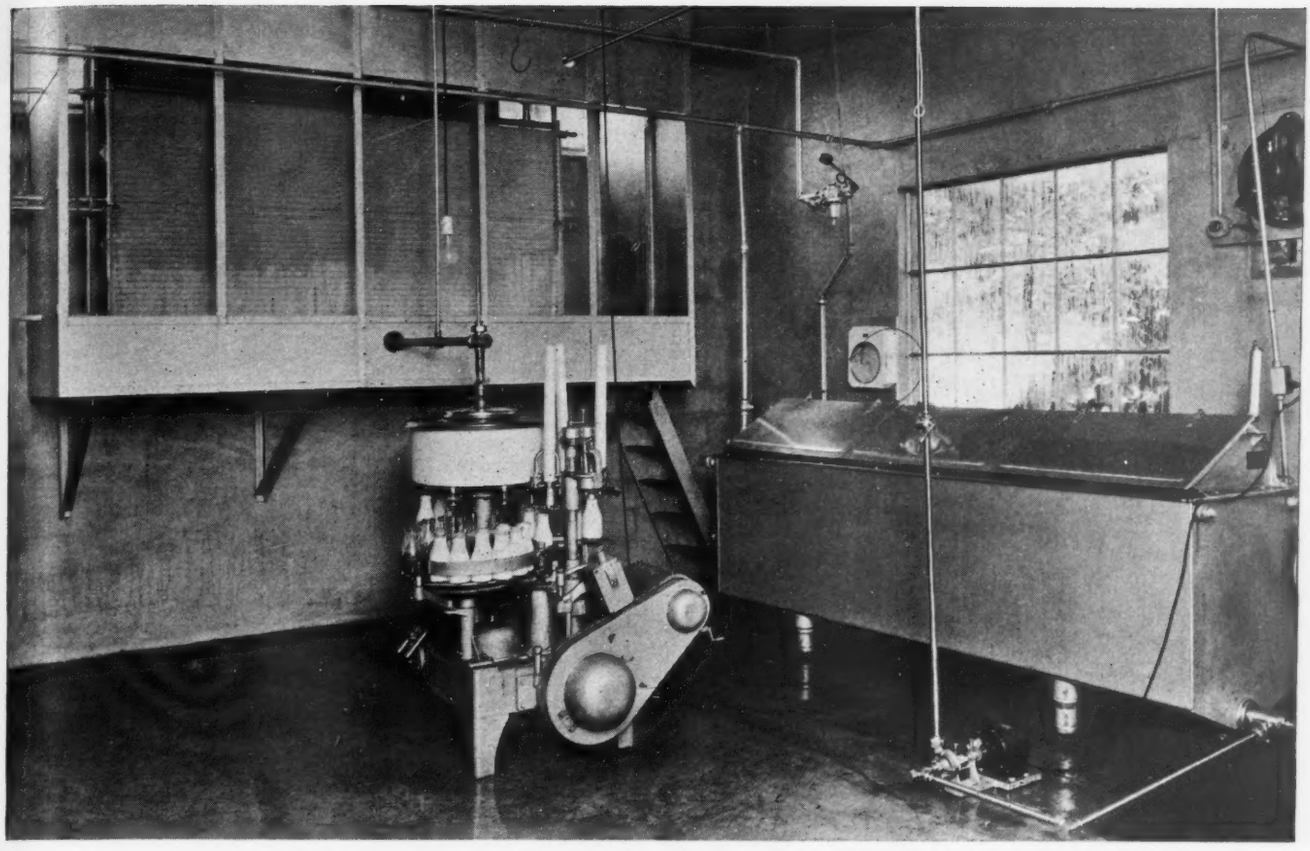
We are producing a superior quality of COKE TIN PLATES specially adapted to the requirements of the canning and packing industry. Demand AMERICAN Cokes, the best obtainable.

This Company manufactures a complete line of Sheet and Tin Mill Products — Black Sheets, Galvanized Sheets, Tin and Terne Plates for all known uses; also U S S STAINLESS and Heat Resisting Steel Sheets.

AMERICAN SHEET AND TIN PLATE COMPANY, Pittsburgh

AMERICAN SHEET AND TIN PLATE COMPANY PITTSBURGH

SUBSIDIARY OF UNITED STATES STEEL CORPORATION



This photograph of the interior of the Ben P. Masseth Dairy of Rochester, N. Y., shows a typical use of Cherry-Burrell 1" Stainless Steel Tubing in combination with Cherry-Burrell Diamond white metal fittings. Other Cherry-Burrell equipment consists of a 200-gallon Hooded Spray Pasteurizer, a size D Bestov Deluxe Cooler, a model G-7 Milwaukee Nuline Bottle Filler and a No. 0 Flexflo Milk Pump.

HERE'S *the* IDEAL COMBINATION *for* ECONOMY *and* LASTING EFFICIENCY . . . CHERRY-BURRELL STAINLESS STEEL TUBING *with* CHERRY-BURRELL NOMAR *or* DIAMOND WHITE METAL FITTINGS!

Seamless and without welds . . . rust-proof . . . scour-and-scrub-proof . . . tough and long lived . . . cold-drawn and annealed . . . CHERRY-BURRELL STAINLESS STEEL TUBING needs no replacements or re-plating and is definitely the most economical sanitary tubing that can be placed in any plant. Highly and permanently polished externally and internally. Acid-resistant and imparts no flavor to any dairy product or other food product piped through it. Easily cleaned, easily polished, solid, perfectly round and a life-time investment in sanitation. 1", 1½" and 2" 18-8 tubing always in stock.

For use with this tubing most dairy and other food-product plants favor CHERRY-BURRELL NOMAR and DIAMOND SANITARY FITTINGS of a highly developed white metal . . . also solid and unplated, highly polished and long wearing under even the most severe service. Write now for prices and complete data on both the tubing and the fittings. CHERRY-BURRELL CORPORATION, 427 W. RANDOLPH ST., CHICAGO.

"Breezes by Bendix"

A BENDIX PRODUCT

This portable breeze has proved a real life-saver in many a plant.

Every factory where overheated, under-ventilated, hazardous or uneconomical atmospheric conditions obtain, needs Bendix Aerospot Fans. Just one of a full range of types and sizes of Bendix P-V-P Ventilating Equipment for moving *more air per kilowatt hour.* Ceiling, wall and floor types—16" two-blade to 36" four-blade. Forged aluminum alloy blades. Write for catalog.

BENDIX PRODUCTS CORPORATION
(Industrial Fan Division)
403 Bendix Drive, South Bend, Ind.

BENDIX FANS

PACKOMATIC PACKAGING MACHINERY IS PROFIT BUILDING IS LOW IN COST IS HIGH SPEED

You Can Cut Costs And Increase Profits!

Packomatic machines are being used by leading manufacturers throughout the world, because they are efficient and economical. Phone—Write—or Wire for complete information without obligation to you.

J. L. FERGUSON COMPANY
JOLIET ILLINOIS.
BRANCH OFFICES
NEW YORK - CHICAGO - CLEVELAND
ST LOUIS - SAN FRANCISCO - NEW ORLEANS

THE YARDSTICK

The Standard by which Values are Measured

LEE STEAM JACKETED KETTLES

There are yardsticks for industries, for products, for equipment, for men—yardsticks with which to measure values and establish standards of comparison.

Talk with executives and production men in the food industries and you'll find that their yardstick, for Steam Jacketed Kettles, Vacuum Pans, Bowls, Tanks and similar processing apparatus, is their LEE EQUIPMENT.

You will profit when you buy Lee Equipment made of stainless steel, nickel or Monel metal. It is fabricated by master craftsmen, specialists in their field, and it looks as good as it is. It is efficient equipment, long-lived, economical—quality equipment you can install with the certainty it will more than pay for itself.

Send for complete information.

LEE METAL PRODUCTS CO.
370 WEST PINE ST.
PHILLIPSBURG PENNSYLVANIA

FOR HAULING FOOD PRODUCTS UNDER YOUR OWN OPERATING CONDITIONS

THERE are no experiments in the 1936 Ford V-8 Trucks and Commercial Cars. Every feature has been PROVED and APPROVED by millions of miles of service under every conceivable condition of load and road and weather. Its 80-horsepower V-8 engine has proved its economy and reliability on the world's greatest proving ground . . . the job itself. Its full-floating rear axle with straddle-mounted pinion . . . full torque-tube drive . . . positive, quick-action safety brakes . . . and many other quality features have proved the soundness of Ford design by their performance in actual service.

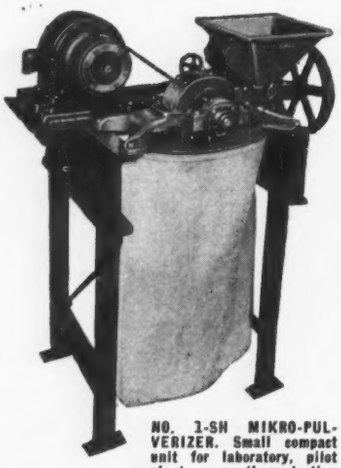
This impressive record offers convincing proof of V-8 Reliability. The cost records of owners firmly establish V-8 Economy. And V-8 Performance needs no confirmation, for it is evident everywhere you look. Thus, Ford V-8 Trucks and Commercial Cars have been PROVED BY THE PAST. Now they have been IMPROVED FOR THE FUTURE. Your Ford dealer invites you to make your own "on-the-job" test without cost or obligation. He will be glad to tell you the details of the money-saving Ford engine-exchange plan. Call him today and set a date.

Convenient Universal Credit Company credit plans make this great truck value immediately available

FORD V-8

TRUCKS AND COMMERCIAL CARS

What's New?



NO. 1-SH MIKRO-PULVERIZER. Small compact unit for laboratory, pilot plant or small production work. Fully equipped, mounted on stand and ready for use as shown.

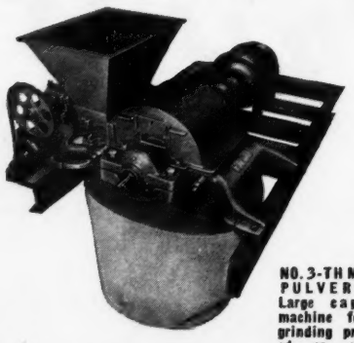
Thru constant effort coupled with properly directed research and a strong desire to improve, the Mikro-Pulverizer continues to be the "modern pulverizer." Here is our contribution to pulverizer progress:

NEW! No. 1-SH Mikro-Pulverizer. New small unit for laboratory, pilot plant and small production work. Furnished with 3 H.P. Motor, Control Switches and Ammeter all mounted on stand. Complete and self contained miniature grinding plant.

NEW! No. 3 Mikro-Pulverizer made in 2 Types—DI for large capacities on bulky feed materials—TH for extremely fine grinding of granular or precrushed materials.

NEW! All sizes and types of the full Mikro line have been completely redesigned for even better results.

NEW! Interesting 32 page catalog illustrating complete new line of Mikro-Pulverizers will be distributed for the first time at the Chemical Exposition. If you do not attend the show, write us for your copy today.



NO. 3-TH MIKRO-PULVERIZER. Large capacity machine for fine grinding precrushed or granular material. Type DI in this same size is recommended when lumpy materials are fed.

See the new Mikros at the Chemical Exposition booths 269 and 270. If you're not there write for the new catalog today.

PULVERIZING MACHINERY COMPANY
109 Valley Road, Roselle Park, N. J.

MIKRO-PULVERIZER •

REG. U.S. PAT. OFF.

Barrels Up to ½ Ton
CAN BE HANDLED BY 1 MAN
with the Bulldog Barrel Truck

Food Factories, concerns in every field have found the *Bulldog* a most efficient truck for handling heavy barrels, either wood or steel. One man does the work of several. Either in loading or unloading, it's not necessary to touch the barrel—the hook and lugs "do the job." Truck weighs only 47 lbs., is strong, well built.

HANDLES ALL KINDS OF BARRELS—
Wood, steel, etc., from 26" to 36" heights—Easily, quickly and most efficiently.

Ask for New Folder FO.

LANSING COMPANY
LANSING, MICHIGAN

Chicago · Kansas City · Minneapolis · San Francisco · New York · Boston · Philadelphia

Keep Your Products on Wheels

ALLIGATOR
TRADE MARK REG. U.S. PAT. OFFICE
STEEL BELT LACING

The smooth, durable hinged joint of Alligator Steel Belt Lacing is the most universally used of all belt lacings. Clinched teeth compress belt ends firmly, reducing destructive internal friction and ply separation. Eleven sizes in steel, "Monel Metal," and alloys for belts up to ⅝ in. Standard boxes, "Handy Packages," and long lengths.

Sold at wholesale and retail throughout the world.

FLEXIBLE STEEL LACING CO.
Sole Manufacturers
4011 Lexington Street, Chicago
In England at 135 Finsbury Pavement, London, E.C.2

REG. U. S. PAT. OFFICE

No Question
about retort temperatures here

Seven Taylor "Fulscopes" installed on canning retorts. But this is only part of Taylor Temperature Control used in this large cannery. It is this "Fulscope" Recording Controller that has been called "one of the most outstanding developments in control instrument history."

And no question about temperatures in any branch of the food industry where there are Taylor Systems of Control. Whether your plant is a cannery or not, Taylor Instruments can be relied on to assure uniform product quality at lower cost.

THE MINUTE that manual regulation of temperature in processing food products gives way to automatic control, at that minute individual plants find a new way to speed up production, maintain more uniform product quality, and save money.

Taylor Instruments and Taylor Systems of Automatic Temperature Control are today busy in every branch of the food industry. Here is one example in a large New York State vegetable cannery:

This plant was preparing for the 1935 pack. In checking over operating methods and equipment, there came up the question of reducing retort and processing costs and of bettering quality. It was decided to have an analysis made of equipment then in the plant. Taylor Engineers made an exhaustive study and submitted recommendations, which resulted in the installation of eleven No. 3 and fourteen No. 4 Taylor Temperature Control Systems.

With the help of Taylor Control this cannery is today packaging a wide variety of vegetables successfully and profitably in all sizes of tin containers. Even No. 10's, a hard size to handle. Manual control is practically eliminated. There is considerable saving in steam. The pack is uniform. The quality of the finished products is higher.

Turn to any division of the food industry and you can find a place and a need for Taylor Control. By this we mean a carefully engineered System of Control comprising the correct Taylor Instruments coordinated to meet the need of a particular plant. Accurate and durable, these instruments are designed and built to meet severest requirements. They soon pay for themselves with the money they save and the quality of products they help to produce.

What about your own specific control set-up for economical production in 1936? Let a Taylor Representative discuss with you any questions of temperature, pressure, rate of flow or liquid level control. For this help, address Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada. Manufacturers in Great Britain—Short & Mason, Ltd., London, England.

Taylor

Indicating Recording Controlling

TEMPERATURE, PRESSURE *and* FLOW INSTRUMENTS

Because—

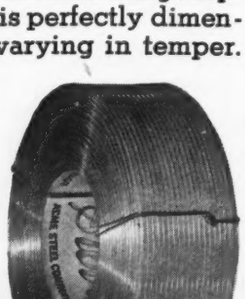
ACME *SilverStitch* REG. U. S. PAT. OFF. is GALVANIZED—Staples Resist Moisture and Corrosion

● You can't keep moisture away from your shipping cases—but, you can use Acme Silverstitch. Galvanized, this finest of stitching wire gives rust a run for its money. Your cartons are protected against blemishes—inside packages, too. Often, protective liners can be eliminated.

But that's only one reason why most leading shippers use Acme Silverstitch. It is perfectly dimensioned, absolutely smooth, unvarying in temper. The 10-lb. coils are one piece. These things mean faster, more even stitching.

Let Acme Silverstitch prove itself. Tell us the size and we'll send a free 5-lb. test coil.

NOTE: For shippers of acidiferous products, where an extremely high rust-resistant stitching wire is required, Acme Blue Label Silverstitch, with an extra heavy coat of galvanizing, is the answer.



Send for free 5-lb. test coil in your size.

ACME STEEL COMPANY

GENERAL OFFICES: 2845 ARCHER AVE., CHICAGO, ILL.

Branches and Sales Offices in Principal Cities

STITCHING WIRE GIVES STRONGEST, SUREST JOINTS IN CORRUGATED AND SOLID FIBRE BOXES

VIKING *Sanitary* ROTARY PUMPS

are

Sanitary — All surfaces smoothly machined . . . impossible for bacteria to lodge and breed. Approved by National and all State Boards of Health.

Simple — Viking has two moving parts . . . which may be disassembled . . . sterilized and reassembled in just a few minutes time with a pair of hands as the only tool.

Speedy — The Viking will deliver just as many pounds per hour as any other pump of the same rated gallonage . . . and do it with less power and slower speed. Pumps with smooth, constant flow . . . without churning, pounding or splashing.

Sturdy — The Viking is as sturdy as the name it bears. It has always been noted for its long life . . . low power requirements . . . and freedom from repair and service expense.

Get the complete Viking facts. Write today for FREE Catalog and Special Food Plant Bulletin.

VIKING PUMP COMPANY

CEDAR FALLS, IOWA

THE *sure* WAY TO PROTECT FLAVOR AND PURITY AND INSURE LOW DEPRECIATION AND CLEANING COSTS .. *handle and process your products in*

ALLEGHENY METAL

Here's a new development in Dough Mixers. The trade is taking to it very kindly, we're told. Bowl, cover, agitator, louvre plates, etc. are all made of ALLEGHENY Metal (*name of fabricator on request*).

There's no guess-work about the value of ALLEGHENY METAL in food-processing equipment. Thousands of installations over the past seven years—*the eloquent test of time*—have proved its ability to raise the standard of food quality . . . at the same time reducing operating, maintenance and depreciation costs. And the reasons why? Immunity from attack by any food or fruit acid . . . tremendous resistance to wear and heat deterioration . . . lasting beauty of surface . . . utter simplicity of cleaning and sanitation . . . *any one of which is reason enough for you to specify "ALLEGHENY METAL" on your next equipment purchase.*

ALLEGHENY STEEL CO. . . Brackenridge, Pa.

Sales Offices and Warehouse Stocks in the Principal Cities

Stocks carried by JOS. T. RYERSON & SON, INC. WAREHOUSES . . . Union Hardware & Metal Co., Los Angeles . . . American Brass & Copper Co., San Francisco Oakland

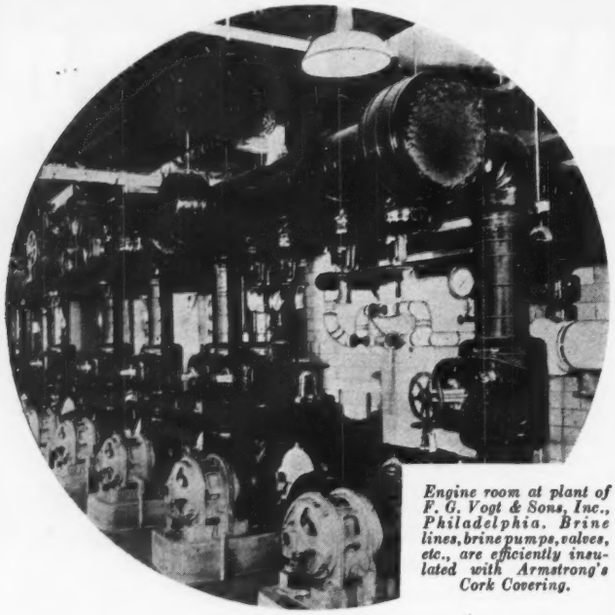
ALLEGHENY PRODUCTS SHEETS FOR AUTOMOBILE BODIES, METALLIC FURNITURE, DEEP DRAWING, ALLEGHENY METAL, ALLEGHENY STAINLESS STEELS, ELECTRICAL SHEETS, STEEL CASTINGS, SEAMLESS TUBING, BOILER TUBES, PIPE.

(Allegheny Metal is licensed under Chemical Foundation patents Nos. 1,316,817 and 1,339,378)

ALLEGHENY METAL

—The time-tested stainless steel

WHY IT'S *Important* TO REFRIGERATION USERS THAT CORK IS COMPOSED OF MILLIONS OF CELLS*



Engine room at plant of F. G. Vogt & Sons, Inc., Philadelphia. Brine lines, brine pumps, valves, etc., are efficiently insulated with Armstrong's Cork Covering.

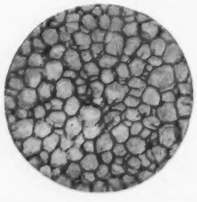
REFRIGERATION losses mean dollar losses . . . higher operating costs. Over a period of time these costs can cut sharply into profits. And the biggest cause of refrigeration waste is inefficient and inadequate insulation. Sound economy, therefore, suggests an insulation which can be depended on not only for *maximum* efficiency, but for *permanent* efficiency as well! Leading users of refrigeration have found that *this* insulation is cork.

Due to its natural cell structure, cork offers in one material all the physical qualities necessary for efficient insulation. Made up of minute air cells so small and so well sealed off from each other that no air can circulate between them, cork has exceptional ability to retard the passage of heat. Nor is that all! Because it is able to withstand the efficiency-destroying effects of the moisture encountered in low temperature work, this dependable insulation assures many years of money-saving efficiency.

Armstrong's Cork Insulation is fabricated in board form for general use and in molded form for pipe coverings. For more than 30 years Armstrong's Corkboard has been standard insulation for walls, ceilings, and floors of all types of cold rooms. Armstrong's Cork Covering is available in Ice Water thickness, Brine thickness, and Special Thick Brine for covering pipes and fittings.

It will pay you to investigate Armstrong's Corkboard and Cork Covering. For complete details and samples, write today to Armstrong Cork Products Co., Building Materials Division, 948 Concord St., Lancaster, Penna.

★NATURE'S OWN BARRIER TO HEAT AND MOISTURE



VIEWED under a microscope, cork shows millions of tiny cells. Entrapped in each cell is a minute quantity of still air. These tiny air filled cells give cork its remarkable resistance to heat and moisture penetration. In the making of Armstrong's Cork Covering, only clean, pure granules of this nonconducting moisture-resistant cork are used.

Armstrong's

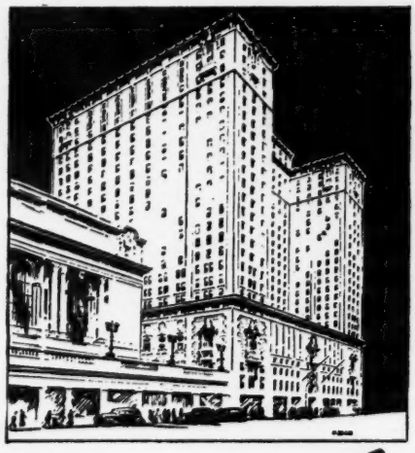
LOW TEMPERATURE INSULATION

Corkboard • Cork Covering

Business Men *Save*

TIME, ENERGY, MONEY

by coming to the



Commodore

"THE BEST LOCATED HOTEL IN NEW YORK"

Excellent meals . . . Courteous service . . . Large, restful, outside rooms . . .

all with private bath

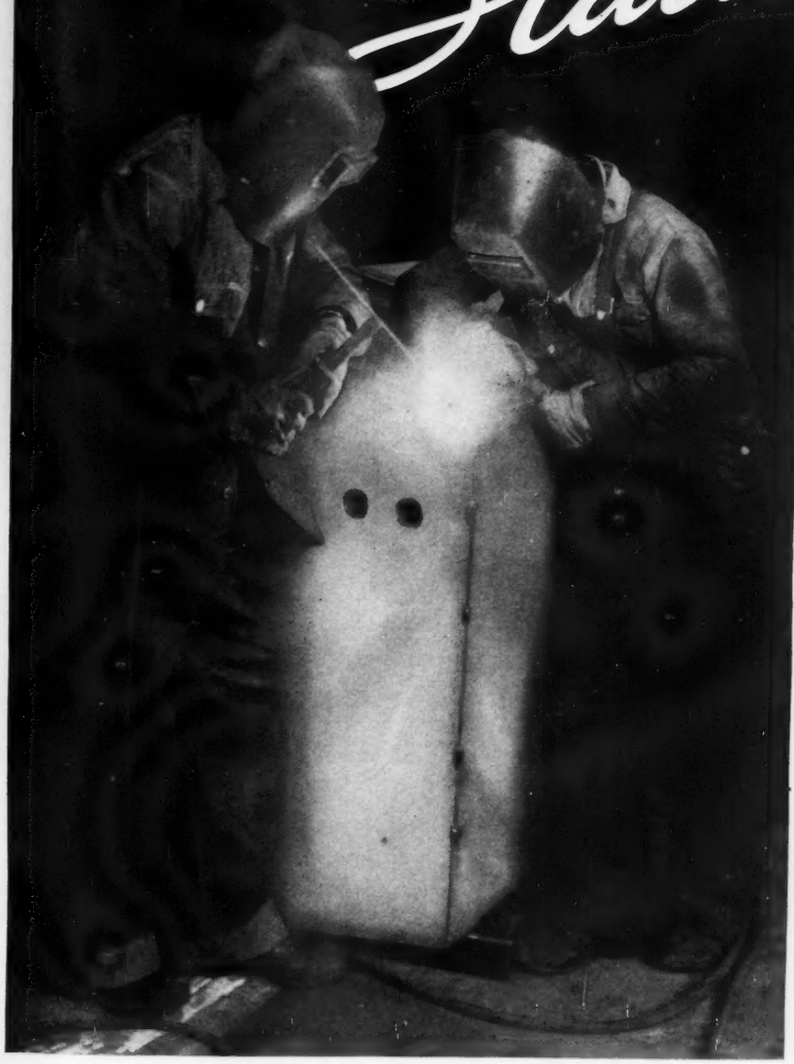
from **$3**

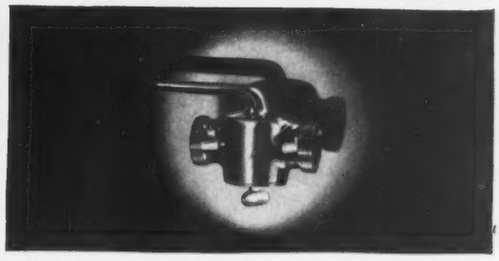
RIGHT AT GRAND CENTRAL NEW YORK

Just a few steps from trains

Frank J. Crohan, President

HERE'S REAL EXPERIENCE WITH *Stainless* STEEL

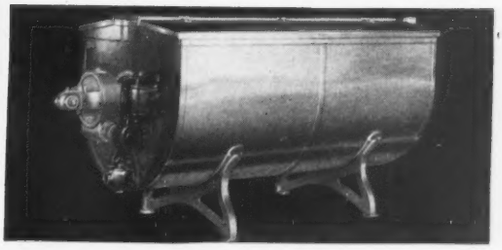


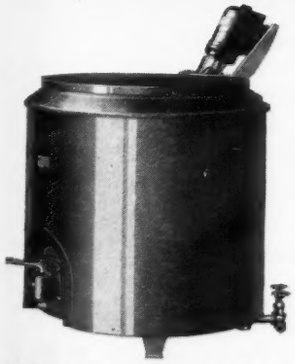


CP Stainless Steel (18-8) Sanitary Fittings—made in T's, Valves and Unions.

Buffing welded seam on CP Stainless Steel vat lining.

CP Round Bottom Coil Vat. Stainless Steel lining and outer covering. Pure corkboard insulation.





CP Model B Pasteurizer—Stainless Steel throughout. Geared-head motor driven agitator. *America's largest selling pasteurizer!*

As early as 1927 Creamery Package research engineers realized the great usefulness, beauty, sanitation and adaptability of stainless steel. Shortly thereafter it was adopted as standard for many of our products.

Our success as fabricators of stainless steel products is recognized by leaders of the industry. Many manufacturing operations and processes now in common use were developed and pioneered by CP.

This experience is tangibly reflected in the excellent design and workmanship of our tanks, vats and fittings. Yet, our prices are no higher.

Please write our nearest office for full particulars.

Creamery Package

THE CREAMERY PACKAGE MFG. COMPANY, 1243 West Washington Boulevard, Chicago, Ill.

BRANCHES: Atlanta . Boston . Buffalo . Chicago . Dallas . Des Moines . Denver . Kansas City . Los Angeles . Minneapolis . New York . Omaha . Philadelphia . Portland, Ore. . Salt Lake City . San Francisco . Seattle . Toledo . Waterloo, Ia.

CREAMERY PACKAGE MFG. CO. OF CANADA, LTD.
267 King St. West, Toronto, Ontario, Canada

GMC

Engineered-for-the-job General Motors Trucks and Trailers Are Built to Out-perform and Out-earn

BUSINESS MEN with loads to haul—from 1½ to 22 tons—are urged to see, inspect and compare the modern GMC trucks.

From the quality 1½-2 ton GMC—with its 47 important money-saving features—right through the exceptionally complete line of General Motors Trucks and Trailers, shrewd truck buyers the country over find the kind of performance and economy they need for modern transportation. Included among them are thousands and thousands of well known fleet owners who will gladly testify from cost-sheet records to the downright value that is inbuilt into every GMC unit.

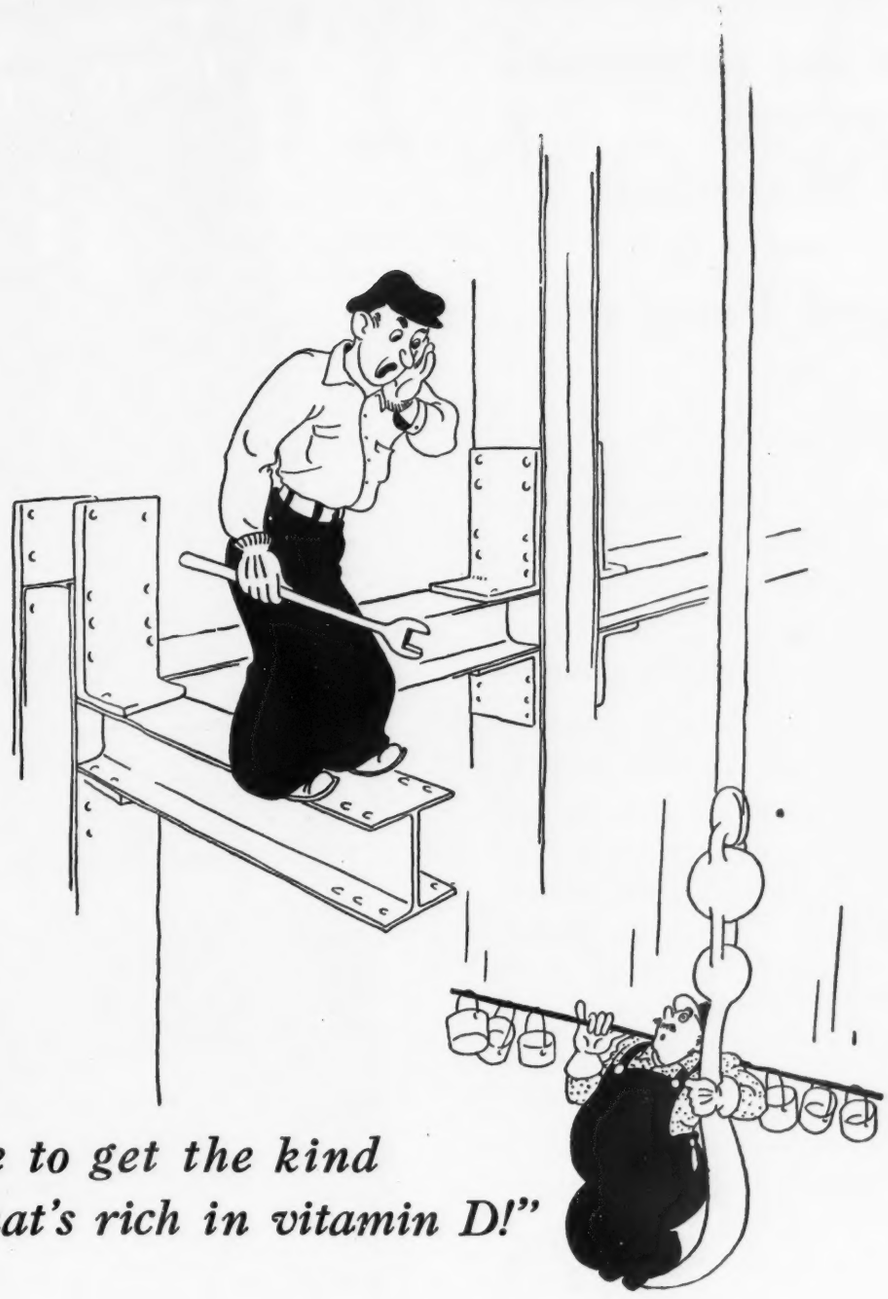
Again we say, see them and compare them! Ask for the facts to prove why seasoned operators by the thousands are swinging to GMC trucks of value.

GENERAL MOTORS TRUCKS and TRAILERS

1½ to 22 Tons

Time Payments Available Through Our Own Y. M. A. C.

GENERAL MOTORS TRUCK COMPANY, PONTIAC, MICHIGAN



"Be sure to get the kind that's rich in vitamin D!"

The price of calves' liver soars . . . the consumption of fresh vegetables and fruits leaps upward . . . irradiated foods stir up an industry . . . the dietary habits of generations are changed—all because a scientific theory promulgated within the space of a few years made a powerful appeal to the public mind, and profits for those who had the enterprise to cash in on it.

IN advertising, as in other fields, those who ride with public opinion—public preference—get better returns.

Does your Chicago advertising take advantage of this basic selling fact? In this market, which spends a quarter of a billion annually for food, the most popular newspaper is the Tribune. It has practically twice as many readers in metropolitan Chicago as any other newspaper.

Chicago department stores, selling $200,000,000 worth of merchandise a year, chiefly to women, get best results by advertising in Chicago's most popular newspaper. They place more advertising in the Tribune than in any other Chicago paper.

General grocery advertisers find the Tribune women audience the most profitable Chicago group of buyers to address. They spend more in the Tribune than in any Chicago afternoon newspaper.

To sell more of your product in this market in 1936, see that the Tribune is on your advertising schedule.

Chicago Tribune
THE WORLD'S GREATEST NEWSPAPER

NEWSPAPER ADVERTISING IS *POINT-OF-SHOPPING* ADVERTISING

SHORTEN the INTERVAL
between
Raw Materials
and
Finished Product
and
YOU INCREASE PROFITS

• Time — the interval between raw materials and finished product — is costly. In many food plants it's *far too costly.* The time men wait for work, the time spent between operations, are hidden costs that can be eliminated.

• In hundreds of food plants . . . LAMSON CONVEYORS are cutting the time factor and getting capacity out of machines — thus increasing capital turnover, reducing inventories, stepping-up production and hastening delivery of finished products — all vital under limited production and highly competitive conditions.

• And time saving is but *one* of the economies LAMSON CONVEYORS can effect!

• Are you *sure* that handling in your plant — for packing, storing and shipping — leaves no room for improvement? Perhaps a single conveyor or a slight change in your present system will mean a substantial saving. It costs you nothing to find out.

ARE OUT-DATED CONVEYORS REDUCING YOUR PROFITS?
A LAMSON SPECIALIST IN FOOD PLANT CONVEYING CAN TELL YOU

LAMSON *CONVEYORS*
FOR THE FOOD INDUSTRY

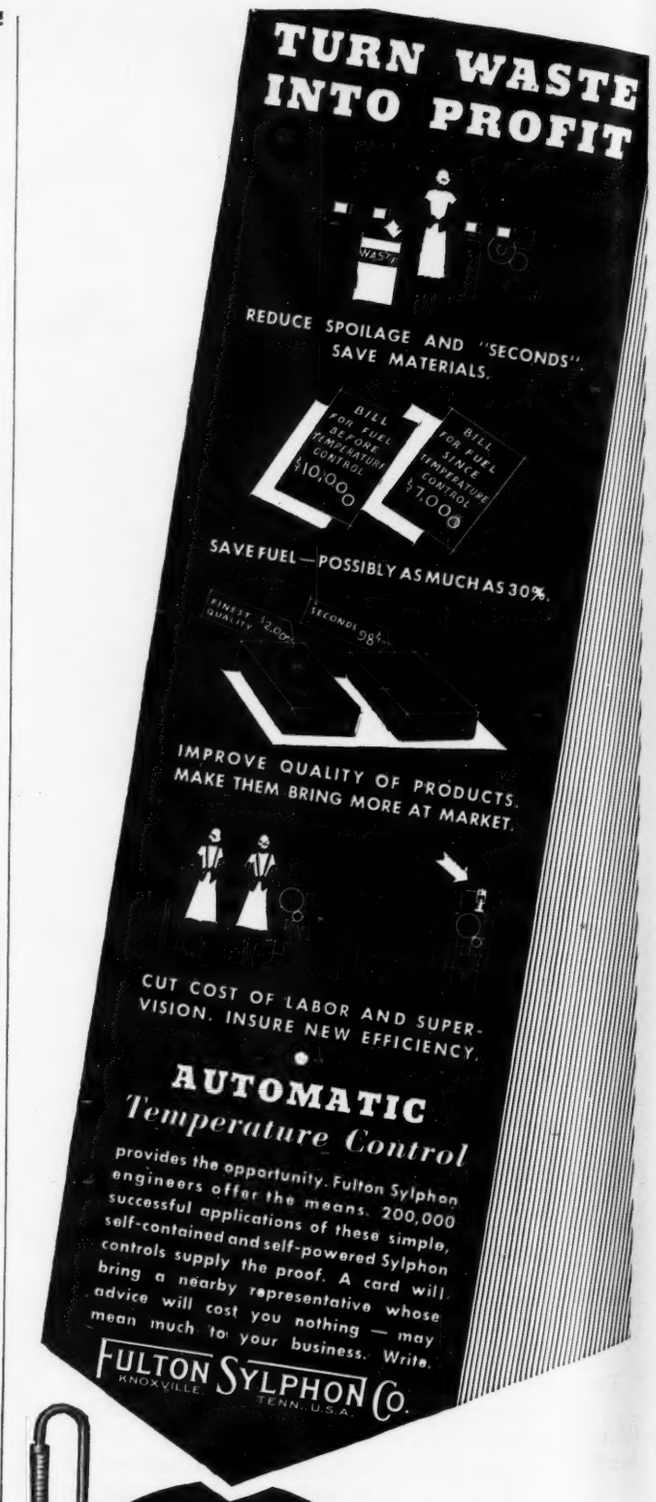
THE LAMSON COMPANY • SYRACUSE, N.Y.

Yes, I'm interested in finding out if you can help us cut costs. Send your Conveyor Book, without obligation.

NAME .....

COMPANY .....

ADDRESS .....


TURN WASTE INTO PROFIT
REDUCE SPOILAGE AND "SECONDS". SAVE MATERIALS.
BILL FOR FUEL BEFORE TEMPERATURE CONTROL $10,000
BILL FOR FUEL SINCE TEMPERATURE CONTROL $7,000
SAVE FUEL — POSSIBLY AS MUCH AS 30%.
FINEST QUALITY 12.00%
SECONDS 98%
IMPROVE QUALITY OF PRODUCTS. MAKE THEM BRING MORE AT MARKET.
CUT COST OF LABOR AND SUPERVISION. INSURE NEW EFFICIENCY.
AUTOMATIC
Temperature Control
provides the opportunity. Fulton Sylphon engineers offer the means. 200,000 successful applications of these simple, self-contained and self-powered Sylphon controls supply the proof. A card will bring a nearby representative whose advice will cost you nothing — may mean much to your business. Write.
FULTON SYLPHON CO.
KNOXVILLE, TENN., U.S.A.

No. 921 — Popular Sylphon Control. Compact, accurate, rugged, reliable. Ask for Bulletin XG 125

A FAST KILLER

Contrary to popular belief, the lion is not a cruel assassin by habit. He kills to eat AND HE IS A FAST KILLER. The late President Theodore Roosevelt is authority for the statement that a fast horse standing a hundred yards from a lion, will be overtaken and killed before it can get into full gallop.

JUST as the lion rules the jungle, so Lo-Bax—another swift, sure killer—rules the favorite among food plant operators who want fast-killing bactericidal solutions. Positive in its action, Lo-Bax kills bacteria quickly—no chlorine product on the market is a faster killer.

And where *clear* bactericidal rinse solutions are required, Lo-Bax again stands apart. For Lo-Bax dissolves quickly even in cold water, making clear sterilizing solutions at the strengths ordinarily required for food plant use.

Lo-Bax is a clean, white, dry powder. It has an extremely low alkaline content and tests 50% available chlorine at all times. Packed in 1¾-lb. glass bottles equipped with replaceable screw-caps, Lo-Bax reaches you full strength and retains its full strength far beyond the normal period of use. With Lo-Bax there is no danger of waste caused by freezing, lumping or loss in strength.

Lo-Bax is easy to use—just add to water by the spoonful as needed. It is low in cost—one bottle of Lo-Bax makes more than 1,000 gallons of bactericidal rinse solution containing 100 parts per million of available chlorine.

Let Lo-Bax help you maintain low bacteria counts. Send for full information today.

The MATHIESON ALKALI WORKS (Inc.)
60 East 42nd Street **New York, N. Y.**

Pioneer Manufacturers of Chlorine Products for Nearly Forty Years

LO-BAX—FOR LOW BACTERIA COUNTS (MADE BY THE MAKERS OF HTH-15)

THE FOLLOWING MANUFACTURERS HAVE TESTED OR EXAMINED THE QUALITY OILS MANUFACTURED BY GULF FOR DIESEL ENGINE LUBRICATION AND HAVE PRONOUNCED THEM SATISFACTORY FOR THE LUBRICATION OF THEIR DIESEL ENGINES.

GULF

Allis-Chalmers Manufacturing Co.
ANDERSON ENGINE & FOUNDRY COMPANY
ATLAS IMPERIAL DIESEL ENGINE CO.
Benz Diesel
Bethlehem Steel Company
BOLINDERS
BUSCH-SULZER BROS. DIESEL ENGINE CO.
CATERPILLAR TRACTOR CO.
CHICAGO PNEUMATIC TOOL COMPANY
CLARK BROS. CO.
Colo-Diesel
CONTINENTAL GIN COMPANY
COOPER-BESSEMER CORPORATION
CUMMINS ENGINE COMPANY
DE LA VERGNE ENGINE COMPANY
ELECTRIC BOAT COMPANY
F. A. B. Manufacturing Co.
Fairbanks, Morse & Co.
Foos
FULTON IRON WORKS CO.
HERCULES MOTORS CORPORATION
HILL DIESEL ENGINE COMPANY
Ingersoll-Rand Company
Junkers Corp. of America
Kahlenberg
Kromhaut Diesel Engine Co.
McINTOSH & SEYMOUR CORPORATION

Mianus
Muncie Oil Engine Company
NATIONAL-SUPERIOR COMPANY
NORDBERG,
R. A. Lister & Co. Ltd.
STANDARD MOTOR CONSTRUCTION CO.
STERLING ENGINE COMPANY
STOVER MANUFACTURING & ENGINE CO.
SUN SHIPBUILDING & DRY DOCK CO.
Superior Gas Engine Co.
THE BUCKEYE MACHINE CO.
THE BUDA COMPANY
The Hooven, Owens, Rentschler Co.
THE MICRO CORPORATION
THE OTTO ENGINE WORKS
The Power Manufacturing Co.
The St. Mary's Oil Engine Co.
THE UNION DIESEL ENGINE COMPANY
Tips Engine Works
VENN-SEVERIN MACHINE CO
Washington Iron Works
Weber Engine Company
WESTINGHOUSE
WINTON ENGINE CORPORATION
Wolverine Motor Works, Inc.
WORTHINGTON PUMP AND MACHINERY CORPORATION

GULF DIESEL ENGINE LUBRICATING OILS

GULF

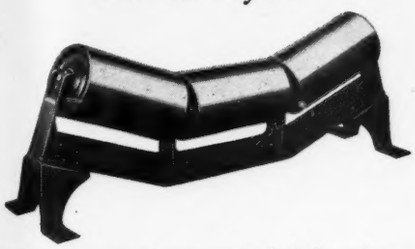
GULF REFINING COMPANY

District Sales Offices

Boston New York Philadelphia Atlanta New Orleans Houston Pittsburgh Louisville Toledo

HANDLE FOOD PRODUCTS *with* LINK-BELT CONVEYORS

Belt Conveyors



Why ruin a good conveying belt by using "cheap" idlers? Free-turning, accurately made idlers assure the conveyor belt a good roadbed for economical operation . . . minimum friction loads . . . and the lowest maintenance cost. Link-Belt makes a full line of anti-friction, pressure-lubricated idlers, as well as various types of plain bearing, grease cup idlers.

Chains for Conveying and Power Transmission

Large stocks of chains made of Promal (the stronger, longer-wearing metal), malleable iron and steel for every conveying and power transmitting service—carried at convenient points throughout the country by jobbers and at our plants and warehouses.

Look for the Link-Belt identifying trade mark. It assures you of the highest quality that the leading chain manufacturer can produce.

Caldwell Conveyor

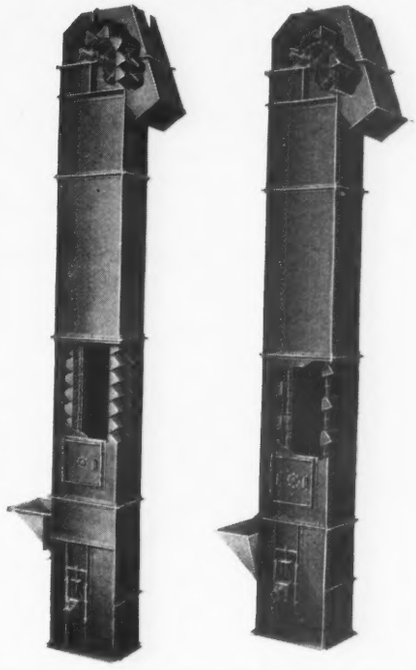
Original Caldwell Helicoid is made only by Link-Belt. It is the continuous spiral conveyor, with flights rolled from a single strip of metal. No laps or rivets to interfere with the free, normal flow of materials. It is strong, durable, long-lived. Helicoid is interchangeable, size for size, with the corresponding sectional flight conveyor.

Caldwell-Moore Sectional Flight Conveyor has gained wide acceptance in many industries. It is easy to renew, and is obtainable in odd diameters and pitches, or with screw of unusual size.

Caldwell Conveyor is also made of special alloys, or various materials which resist corrosion and heat.

Link-Belt Ribbon Conveyor has a continuous spiral steel "ribbon," with a clear space between it and the central pipe to which the ribbon is secured. It is particularly adapted for handling sticky material.

Bucket Elevators



Back of Link-Belt's line of Bucket Elevators and Conveyors for handling loose materials in bulk, is an engineering and manufacturing experience of over half a century.

General Catalog No. 600

This Link-Belt Catalog and Engineering Handbook of 1024 pages, will be sent to

those who use or specify elevating, conveying and power transmitting equipment.

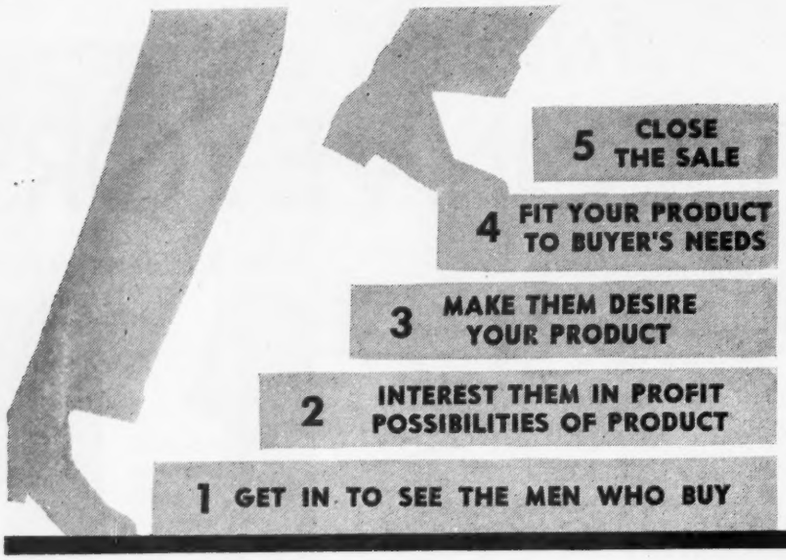
LINK-BELT COMPANY

5044-B

Leading Manufacturers of Equipment for Handling Materials and Transmitting Power

CHICAGO Plant, 300 W. Pershing Rd. CHICAGO, Caldwell-Moore Plant, 2410 W. 18th St. INDIANAPOLIS, Ewart Plant, 220 S. Belmont Ave. PHILADELPHIA Plant, 2045 W. Hunting Park Ave. INDIANAPOLIS, Dodge Plant, 519 N. Holmes Ave. SAN FRANCISCO Plant, 400 Paul Ave. ATLANTA Plant, 1116 Murphy Ave., S. W. *Offices in Principal Cities* In Canada—Link-Belt Limited—Toronto Plant: Montreal; Vancouver

See Our Exhibit—Chemical Industries Exposition—Space 267-268 Dec. 2-7


5 CLOSE THE SALE
4 FIT YOUR PRODUCT TO BUYER'S NEEDS
3 MAKE THEM DESIRE YOUR PRODUCT
2 INTEREST THEM IN PROFIT POSSIBILITIES OF PRODUCT
1 GET IN TO SEE THE MEN WHO BUY

Let ADVERTISING
take the first 3 steps

Your salesmen's time is too valuable to be spending hours on the preliminary steps of getting attention, interesting the prospective buyer, and creating desire. Advertising can do these things at lower cost.

Advertising will free your salesmen for the real job of selling. It permits them to specialize on fitting the product to the buyer's needs . . . *and to concentrate on closing the sale.*

Let us show you how really low the cost is and how really effective the job can be, when you back up your sales effort with advertising in the waste-free McGraw-Hill Publications.

McGRAW-HILL PUBLICATIONS

McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York, N. Y.

American Machinist
Aviation
Bus Transportation
Business Week
Chemical and Metallurgical Engineering
Coal Age
Construction Methods
Electrical Merchandising
Electrical West
Electrical World
Electronics
Engineering and Mining Journal
Engineering News-Record
Factory Management and Maintenance
Food Industries
Metal and Mineral Markets
Power
Product Engineering
Radio Retailing
Textile World
Transit Journal

Containers by Hackney Provide Special Advantages to Food Shippers

• *Seamless bilged-type, full removable head barrel with single bolt closure, made of aluminum.*

This Hackney barrel is made to meet the particular needs of food shippers. It provides exceptional lightness and ease of handling without reduction of strength qualities.

There are no seams or welds at any point. The chimes are smooth and wide. The sides have no rivets, bolts or projections of any kind. The head opens fully, with outward-curling top.

This provides extreme ease of cleaning as well as fast filling and emptying. The seamless construction means advantages in cleanability that cannot be equaled by a pieced container.

Pressed Steel Tank Company has had long and wide experience meeting the needs of food shippers. The Hackney method of manufacture is available for containers of various types, and in stainless steel, nickel, Monel metal, aluminum, Herculoy, specially coated steel, and other metals in addition to steel.

PRESSED STEEL TANK COMPANY

208 S. La Salle St. Bldg., Room 1173, Chicago, Ill. 1349 Vanderbilt Concourse Bldg., New York, N. Y. 6601 Greenfield Ave., Milwaukee, Wis. 669 Roosevelt Bldg., Los Angeles, Cal.

Hackney
MILWAUKEE

CONTAINERS FOR GASES, LIQUIDS AND SOLIDS

MOTOCO

RECORDING and DIAL INDICATING THERMOMETERS

MOTOCO Industrial Instruments have proven their dependability through many years of service on all classes of equipment requiring accurate temperature indication.

The application of MOTOCO Industrial instruments to any equipment or operation on which close temperature regulation is an essential factor, is your assurance of greater efficiency and economy.

The MOTOCO solid liquid-filled movement is of exclusive Moto Meter design; sturdily constructed to give long life service under all operating conditions. MOTOCO Industrial Instruments have evenly calibrated, easy reading scales; movements are fully compensated and dial readings represent true temperatures at the point of bulb installation.

Advise us your temperature indicating and recording problems. We shall be pleased to offer our suggestions and quote on your requirements.

MOTOMETER GAUGE AND EQUIPMENT CORPORATION

LA CROSSE • • • WISCONSIN

Like the New Cars—

CHRY
CADIL
BUICK
LA SA
NASH
AUBU
LINC

SPEED IN RESERVE

They tell you at the auto shows that 90 miles an hour is built into their cars, not so you can go that fast, but so you can know your car is fine enough to do ninety if you ever demand it. The speed is practically a by-product of top-notch engineering.

We point with equal pride to Service Casters (truck wheel units). They are constructed to GO—and GO fast! A service Castered dolly, floor or platform truck is made to go faster, longer, than any other material handling unit—wheel size and speed of push being equal.

Whether your plant handles loads at break neck speed or not, the qualities that make speed possible are evidence of fine light free construction sure to last through years of service. Write for data on scores of Service Caster types suited to your equipment.

SERVICE CASTER & TRUCK CO.
525 N. Albion Ave., ALBION, MICHIGAN

These casters are so constructed with fine bearings (Timken, Hyatt, and our own case-hardened raceway with chrome-nickel steel ball bearings)—so designed for stresses, thrusts and strains that equipment on which they are installed becomes swiftly and easily portable. Furnishable with floor protective wheels—rubber-tired, Servite and Textolite.

SERVICE CASTERS AND TRUCKS

Why the High Speed FWD is Winning Wide Popularity for All Around Service

FOUR-WHEEL-DRIVE with full center differential action gives the truck the necessary traction for faster service on any type of going. Set-back front axle insures correct weight distribution. Front axle is most rigid type known in automotive practice. Power on the front wheels utilizes the weight for securing additional traction . . . a big advantage in getting in and out of the difficult places when necessary. Wide range of gear ratios permits heavy lugging or fast travel as required. Truck is closely coupled, giving better control under any condition. Transmission gears cannot be stripped. The unit is engineered for proper mounting of any type of body or special auxiliary equipment so that maximum operating performance is obtained.

FACTS ABOUT FWD TRUCKS

Faster Service. FWD's with their powerful engines, wide range of gear ratios and four-wheel traction cut down trip-time by being able to "make" the hills, curves, and poor going, faster than average trucks. No necessity for over-speeding on the straight stretches.

Greater Safety. Front axles are set back. *Power*, as well as load on all four wheels, gives the FWD sure footing on slippery pavements, in congested traffic, and when going around curves.

Wider Range of Operation. Four-wheel traction enables the FWD to handle its regular hauling job easily and do the tough jobs as a matter of course.

Greater Dependability of Service. Reserve power, rugged construction throughout, and true application of the four-wheel drive principle, insure continuous operation under any condition. Backed by a nation-wide organization of parts depots and service men available at a moment's notice.

Operating Economy. Definite savings are made in gasoline, tire wear, maintenance cost, and other "out-of-pocket" expenses. This is the result of equal distribution of power and load and scientific four-wheel drive construction throughout.

FWD TRUCKS

Write for full particulars on the High Speed FWD

THE FOUR WHEEL DRIVE AUTO COMPANY
Clintonville, Wisconsin
Canadian Factory: Kitchener, Ontario

☐ The Snow Removal Problem ☐ Use of Extreme Pressure Lubricants ☐ Truck and Trailer Size and Weight Restrictions ☐ Effects of Front Wheel Stability on Public Safety ☐ Purdue University Efficiency Test ☐ Cutting Costs with the FWD Road Maintainer ☐ Making the Most of Controlled Power.

Mr._____

Title_____

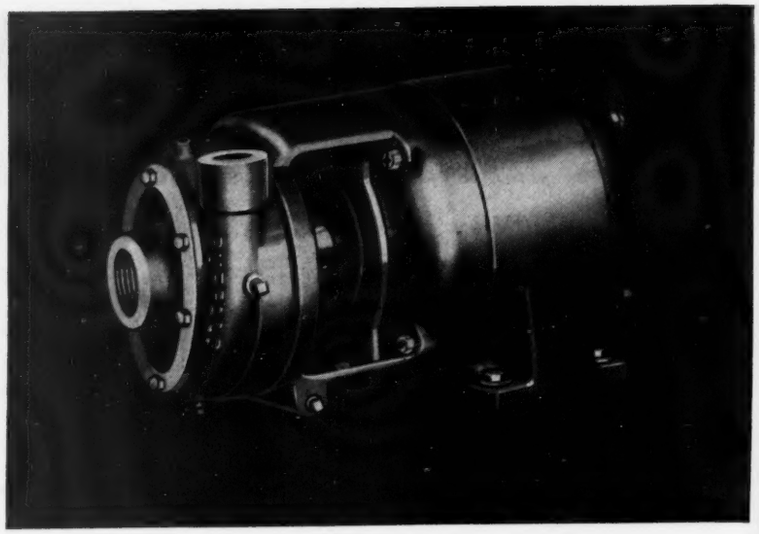
Address_____

City_____ State_____

BACKED BY AN INTERNATIONAL SERVICE SYSTEM

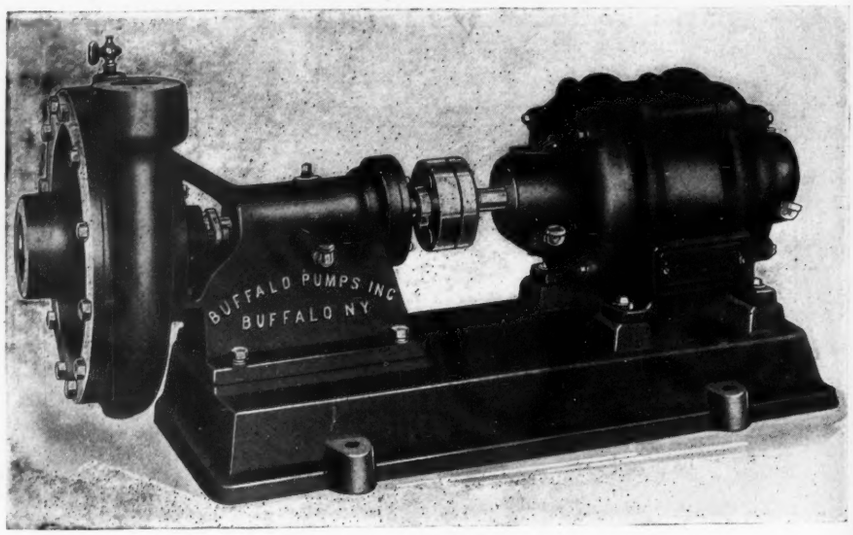
Cut your costs

with these modern pumps



Buffalo Close Coupled Pump for general service work.

Faced with the operating facts, you may be surprised at how much you pay for horsepower on old fashioned, inefficient pumps. The modern, high-speed, high-efficiency Buffalo Pumps shown here may cut your operating costs considerably, and will certainly cost less for maintenance. Why not get data and check up on your pumps, now?



Buffalo Double Ball Bearing Single Suction Pump.

Write for Bulletins

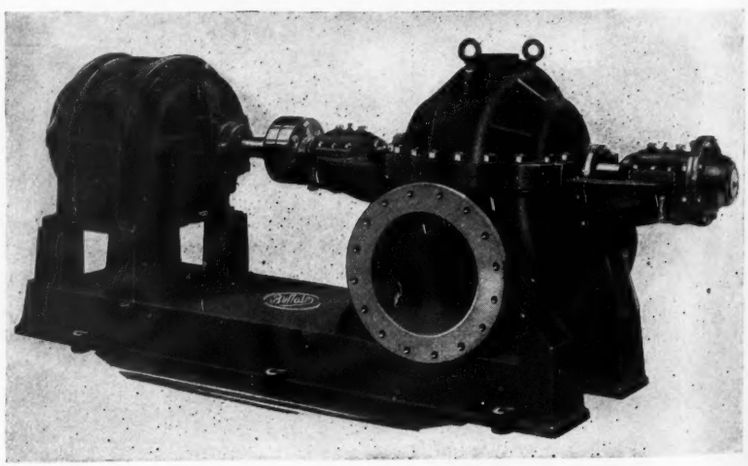
Up-to-date features described and illustrated in three new bulletins.

No. 975-G—Close-coupled Single Suction Pumps.

No. 976—Double Ball Bearing Single Suction Pumps.

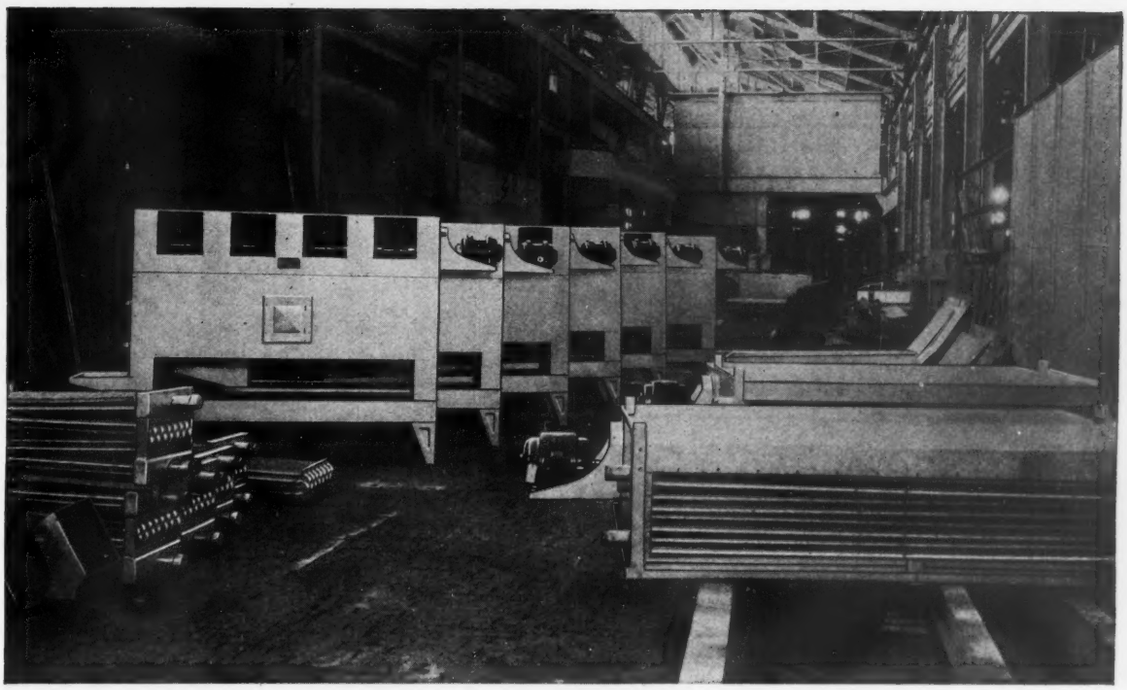
No. 955—Double Suction Pumps.

Buffalo Pumps, Inc.
181 Mortimer St., Buffalo, N. Y.
In Canada: Canada Pumps, Ltd., Kitchener, Ont.



One of the larger Buffalo Double Suction Pumps for general service.

"Buffalo" High-Efficiency Centrifugal Pumps



Floor Type Unit Coolers in Assembly Bay at Our Buffalo Plant

Cash-in on our engineering

Buffalo engineers have been active in the cooling, heating and ventilating field for many years. They know the value of well-balanced design—they specify certain manufacturing processes necessary to provide the best in finished equipment.

Get the benefit of this accumulated experience! Select efficient, sturdy, practical Buffalo Units—and be satisfied with results.

We are not contractors, do no installing. We shall be glad to send you complete information on Buffalo Unit Coolers.

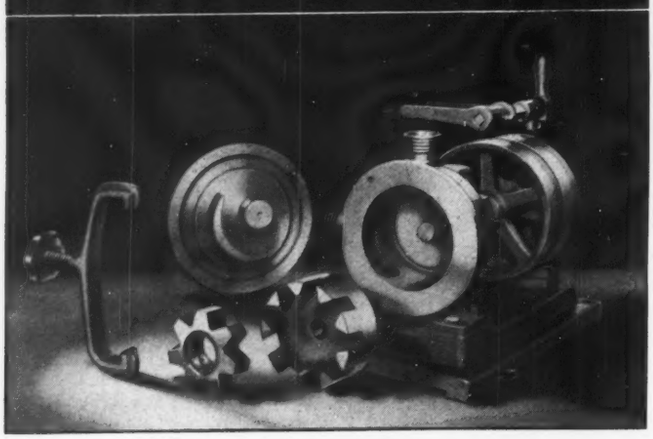
Buffalo Forge Company

472 Broadway, Buffalo, N. Y.

In Canada: Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" Unit Coolers
Comfort Conditioners

LIQUIDS WON'T CHURN IN *This* ROTARY PUMP



F-M Perfection Rotary Sanitary Pump disassembled for cleaning—Note extremely smooth, clean inside finish. Easy to clean, quickly accessible, meets all requirements of any State Board of Health.

NEW *type helical gear will pump milk, cream and other liquids with steady, non-churning flow.*

Any liquid that can flow through a pipe travels more smoothly and without churning when it is handled by an F-M Perfection Rotary Pump.

Milk, cream, buttermilk, ice cream mix, purees and liquid food products of every kind are pumped without the shocking jolt and surging caused by old-fashioned rotors. For a newly designed rotor *slices* the liquid where it enters the intake port —instead of driving it along with hammer blows.

For complete information, write Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill. 34 branches at your service throughout the United States.

Pioneer Designers and Manufacturers of POWER, PUMPING AND WEIGHING EQUIPMENT 105 Years

FAIRBANKS-MORSE PUMPS

6518—PA24.18

WRITE TODAY!

A number of foresighted manufacturers are spending money in these pages to tell you about their products and service. These men are justifying their belief in industrial America's future and their faith in advertising. Pull along with them by finding out what they can do to help you. Advertised products are dependable products.

A perfect '36! Ah, me!
Some *waist* they had in days of old;
With model '36 machines
The *waste* is almost naught, I'm told.

* * * * *

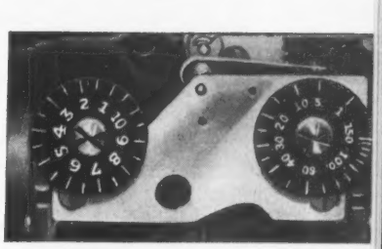
See them at the Annual Exhibition
Stevens Hotel, Chicago
January 19-24, 1936

"TUNE IN" To Process Control

...as Easily as dialing a Radio

BROWN Air-o-Line

Easily Adapted Then Fully Automatic



AUTOMATIC RESET DIAL
The graduated dial makes it possible to change the rate at which the control point is automatically reset. No resistance tubing is used.

THROTTLING RANGE DIAL
Graduated from 1 per cent to 150 per cent throttling range. Sufficient to provide flexibility required to meet any type of control problem.
Instantly adjustable without removing chart plate.

Other features and models are fully described in Catalog 8900. Write for it.

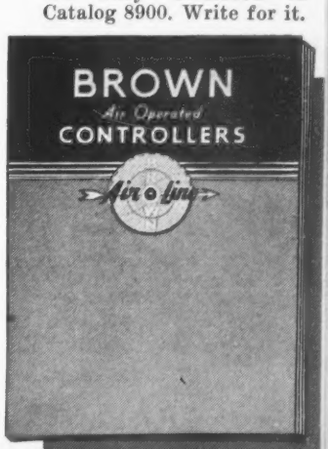
The use of Graduated Dials for both "*Throttling Range and Automatic Reset*" in the Brown *AIR-o-LINE* is a revolutionary development in air operated controllers. They provide a means for "tuning in" to your specific process requirements, simply and quickly, without dismantling the controller or interrupting its control operation. Operators are encouraged to secure "best possible," not just "good enough," control results, so apt to be present where adjustments are complicated and time-consuming.

Brown *AIR-o-LINE* assures accurate measurement and precise control of temperatures, pressure, flow and liquid level—*AIR-o-LINE* is set with the same simplicity as dialing a radio—once it is "tuned in" it becomes fully automatic. Brown *AIR-o-LINE* not only confines the process within limits but it "lines out" control at the exact desired control point, regardless of load or thruput changes.

Brown *AIR-o-LINE* has everything you have wished for in air operated control—it "Recognizes," "Analyzes" and "Corrects" for any departure from the exact control setting—without "Cycling," "Drifting" or shifting of the control point.

Modernize your process control with this MODERN air operated instrument. Brown *AIR-o-LINE* is more than a controller—it's a system that will aid you to reduce costs—designed for outstanding performance with simplicity.

Learn more about Brown *AIR-o-LINE*—you can rely on its accuracy—be confident of its dependability. Write for Catalog No. 8900. BROWN INSTRUMENTS, a division of Minneapolis-Honeywell Regulator Co., 4502 Wayne Avenue, Philadelphia. Offices in all principal cities. Canadian Factory, 117 Peter Street, Toronto, Canada.



BROWN AIR OPERATED CONTROLLERS

OUTSTANDING PERFORMANCE WITH SIMPLICITY

NO IMPURITIES CAN GET INTO YOUR FOOD PUMPS IF YOU USE

KLERO

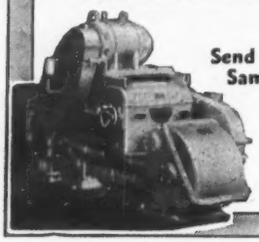
PACKING

The lubricant in *"KLERO,"* having a high melting point, will give long economical service on pumps handling hot soups, materials to be canned, and foodstuffs in general, especially where the temperature is high.

No odor, taste or stain can get to the finished product.

Oily graphite, grease, or other lubricants containing contaminating ingredients, should not be used.

"KLERO'S" lubricant allows the use of a well-lubricated packing on rods and shafts of food pumps without jeopardizing the purity of the product.



Send for Free Working Sample. State Size.

GREENE, TWEED & CO.

Sole Manufacturers

109 Duane St. New York

See

PROCTOR DRYERS

at the Chemical Show

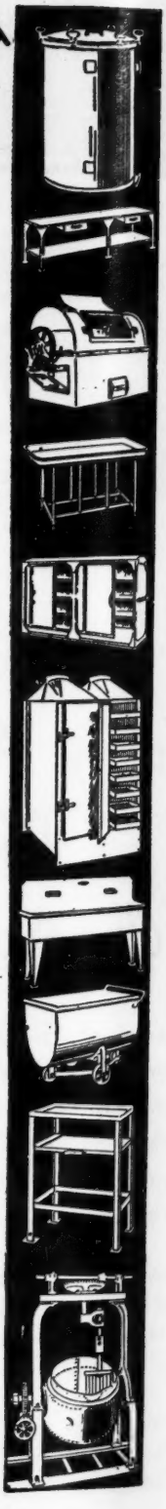
At the Exposition of Chemical Industries, Grand Central Palace, New York, Dec. 2 to 7, you will find in Booth 15, main floor near main entrance, 1500 sq. ft. of floor space devoted to an exhibit of outstanding new developments in DRYING MACHINERY, with Proctor engineers in attendance, competent and willing to help you in any problem of industrial drying.

PROCTOR & SCHWARTZ, INC.

Builders of Dryers for Industries Since 1883

IF YOUR EQUIPMENT

***was* X-RAYED *while in* OPERATION**



Impurities from corroded metal mixing with your food products not only ruin the taste and color that your experts in cookery have striven for but also the reputation on which you spent so much in advertising.

The modern manufacturer of food products takes no chances with his equipment—that is the reason the KOVEN organization has been called upon by some of the foremost manufacturers when they have a problem concerning corrosion.

If you have an equipment problem whereby stainless steel or other non-corrosive metals are used, our engineers will be pleased to cooperate with you.

Among the many KOVEN products:

Stainless Steel	Mixers, All Kinds
Aluminum Sheet Fabrication	Monel Metal Fabrication
Boxes, Tote, Waste Cans	Pails, Special Heavy
Chemical Apparatus	Pans, All Types, All Metals
Coils and Pipe Bends	Sinks, Scullery and Factory
Copper Sheet Fabrication	Tables, Galvanized or Monel
Galvanizing Work	Tanks, All Types, All Metals
Kettles, All Types, All Metals	

L. O. KOVEN & BRO. INC.

154 OGDEN AVE.

JERSEY CITY, N.J.

Splash Proof Motors

are only *part* of the complete line of

Crocker-Wheeler Motors

for Food Plants

Any other type you need—Fully Enclosed, Fully Enclosed Fan Cooled, or Drip Proof, for instance—will be found in the Crocker-Wheeler line.

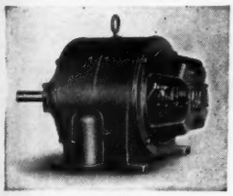
From $\frac{1}{8}$ up to 10,000 HP. In a-c polyphase, or d-c. In all standard capacities, supplied with sleeve type or anti-friction bearings.

Into nearly a half century of motor building is packed much experience. Particularly true, you'll discover, when you realize the Dependability under a Crocker-Wheeler nameplate. In any food plant it's a discovery well worth making.

As for your difficult problem involving an out-of-the-ordinary application, then again this long experience counts heavily. To those who have enjoyed the experience, it has become as natural to expect the solution of such problems by Crocker-Wheeler engineers as to expect another day tomorrow. That, by the way, is an experience well worth having.

Vertical Motor

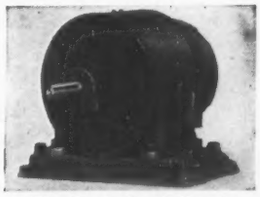
Vertical Motor



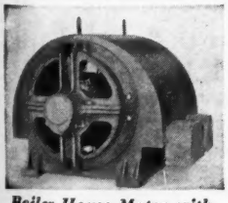
Open Motor

Semi-Enclosed (Roller Bearing)

Enclosed Pipe-Ventilated



Totally Enclosed (rear)



Boiler House Motor with Bearing Brackets

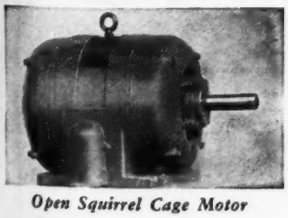
Explosion Proof Motor

CROCKER-WHEELER

ELECTRIC MANUFACTURING COMPANY

AMPERE, NEW JERSEY

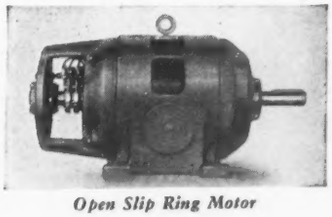
Birmingham	Cincinnati	New York
Boston	Cleveland	Philadelphia
Buffalo	Detroit	Pittsburgh
Chicago	Houston	San Francisco



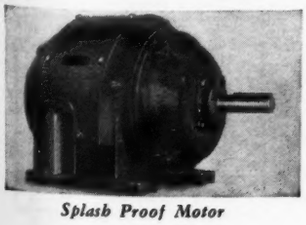
Open Squirrel Cage Motor

Small Totally Enclosed Fan Cooled

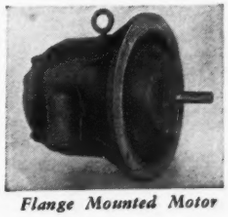
Vertical Motor



Open Slip Ring Motor



Splash Proof Motor



Flange Mounted Motor

Large Totally Enclosed Fan Cooled

Totally Enclosed Motor

SEARCHLIGHT SECTION

EMPLOYMENT : BUSINESS : OPPORTUNITIES : EQUIPMENT—USED or RESALE

UNDISPLAYED—RATE PER WORD

Positions Wanted (full or part-time salaried employment only), 5 cents a word, minimum $1.00 an insertion, payable in advance.
Positions Vacant and all other classifications 10 cents a word, minimum charge $2.00.
Proposals, 40 cents a line an insertion.

INFORMATION:

Box Numbers in care of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads. Replies forwarded without extra charge.
Discount of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

1 inch $5.00
2 to 3 inches..... 4.75 an inch
4 to 7 inches..... 4.50 an inch
Other spaces and contract rates on request.
An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page. Food Industries

COPY FOR NEW ADVERTISEMENTS RECEIVED UNTIL THE 22ND OF THE MONTH FOR THE ISSUE OUT THE FOLLOWING MONTH

POSITION VACANT

CHEMIST wanted. College graduate. Experienced in food products and flavors. Must have factory experience. Apply P-224, Food Industries, 330 West 42d Street, New York City.

POSITIONS WANTED

CHEMIST, M.S., Ohio State, '32. Specialized in food and dairy chemistry. Laboratory expert grounded in fundamentals, especially organic and physical chemistry; mathematics, physics, bacteriology and dairy technology. Highly recommended young married man with two years' teaching and three years' dairy laboratory experience, desires steady work with opportunity for advancement. J. T. Poffenberger, Morenci, Michigan.

PLANT MANAGER, broad experience as plant manager, chemist in food industries, good references concerning character and ability, can figure costs. PW-226, Food Industries, 330 West 42d Street, New York City.

FOOD TECHNOLOGIST, formerly employed by state, government, large industrial companies, experienced in research, development, production, references concerning training, character, ability. PW-227, Food Industries, 330 West 42d Street, New York City.

BUSINESS OPPORTUNITY

Old Established Manufacturer

of well known brand ketchup, chili sauce, tomato juice, with highest quality reputation and excellent distribution wishes to retire. Wonderful opportunity, particularly for firm wishing to add these lines to its other food products. To a responsible party, reasonable terms will be offered. BO-225, Food Industries, 330 West 42nd Street, New York City.

What
A GOLD AWARD
means to
YOUR TRUCKS
SEE PAGES 18-19

FOOD INDUSTRY BARGAINS

25—Copper & Aluminum Jack. Kettles, 15 to 500 gallons capacity.
5—80 qt. Mayonnaise Mixers; Century, Read and Day makes.
10—Dry Powder Sifters & Mixers, 50 lb. to 400 lb. capacity.
10—Fillers for jars, cans, bottles and tubes, single and multiple spouts.
5—World, Ermold and National semi-automatic, motor driven Labelers.
1—World Rotary Automatic Labeler.
8—J. P. Devine Rotary Vacuum Dryers, 3x12', 3x15', 3x25', 5x25', 5x33'.
10—Devine Vacuum Shelf Dryers, all sizes.
1—Devine double drum Atmospheric Dryer, 4x9'
5—Copper Jacketed Vacuum Pans, 75, 200 and 500 gals.
1000' Gravity Roller Conveyor.
Miscellaneous—Glass Lined Tanks, Filters, Filter Presses, Mixers, Vacuum Pans, Mills, Screens, Dryers, Pulverizers, Pumps, etc.

Note: We buy your Idle Equipment for Cash. Send us a list.

CONSOLIDATED PRODUCTS COMPANY, Inc.
Barclay 7-0600 13-17 PARK ROW, N. Y. C.

Modernize with Guaranteed
UNION
Rebuilt Machinery
ATTRACTIVE PRICES · RELIABILITY · PROMPT DELIVERY
ALL MACHINES RELIABLY GUARANTEED FOR ONE YEAR

Outstanding Values

50—Copper and Aluminum Kettles, Steam Jacketed, 10 to 500 gallon capacity, with and without agitators, tilting and with drawoffs.
20—Dough and Food Products Mixers, single and double arm, 1 to 10 barrel.
8—Hobart 80 qt. capacity, 4 speed model 80M mixers. Peanut Butter Machinery.
Dry Powder Mixers, 100 to 2,000 lb. capacity.
Fliter Presses, Tanks, Grinding Mills, Bottle Filling and Pasteurizing Machines, Rotary Steam Dryers.

REFRIGERATING AND AIR CONDITIONING EQUIPMENT

65 ton Carrier Refrigerating Machine, complete with 75 H.P. motor attached, late construction, automatic, compact and self-contained, with full equipment, on one base—also corresponding—
65 ton capacity, Atmospheric Conditioner Corporation Air Washer and Conditioner, with motor driven Brine Pump, Blower, etc.
52 ton capacity, Frick, steam driven, Refrigerating Machine, complete with full equipment.
105 ton capacity, Frick Refrigerating Machine, driven by 150 H.P. Synchronous motor with Exciter and full equipment.
York and Frick, 2 cyl. upright, 5 to 25 ton, motor driven Compressors complete; also York and Corner Corresponding Air Conditioners.

1—Hurricane Dryer.
5—World, Ermold and National Bottle Labelers.
15—Vac. Pans, Copper, 50 to 500 gal.
1—Sweetland Filter Press, 15½" plate.
1—Patterson Ball Mill, 6'x10'.
1—Hardinge Mill.
1—4-ft. Milk Vacuum Copper Condensing Pan, with vacuum pump.

We pay cash for single machines or entire plants

UNION STANDARD EQUIPMENT CO.
318-322 LAFAYETTE ST. NEW YORK, N. Y.

Copper Steam Jacketed
KETTLES

New and Rebuilt Guaranteed, 5 to 500 gal. capacity, with and without agitators, guaranteed steam pressure, immediate shipment.

New nickel, monel and stainless steel steam jacketed kettles, 20 to 500 gal. capacity, with and without agitators.

New copper pulp coils for 500 and 1000 gallon tanks.

HAMILTON COPPER & BRASS WORKS
Hamilton, Ohio
Responsible coppersmiths since 1871

WANTED

WANTED
TWO NO. TEN AYARS BEAN FILLERS
Used, Good Condition
MARSHALL CANNING COMPANY
Marshalltown, Iowa

CENTRIFUGAL EXTRACTORS

Washing—Drying Machinery. Rebuilt like new. All sizes and makes. Guaranteed. Sacrifice Prices.

WILLIAMS LAUNDRY MACHINERY CO.
1780 Broadway, New York City
Phone CIrcle 7-1393

TO HELP YOU
SELL WHAT YOU NO LONGER NEED
"Searchlight" Advertising

Fillers

Day, Stokes and other Powder Fillers; FMC, Kiefer, U. S. and other makes Gravity and Liquid fillers.

Filters

FMC 12" Disc Filters, Kiefer, International, Dietz, U. S. Single and Multiple Disc plates; Alsop single and double barrel Pressure Filters.

NEW and RECONDITIONED EQUIPMENT

Sifters and Mixers

Day 50, 100, 200, 400, 800 lbs. capacity; Gedge-Gray 800 lbs. capacity; Unique 600 lbs. Jacketed; Day Invincible Mixers; W. & P. 100 and 30 gallon working capacity; Day, Ross and other makes double arm Mixers; 2½, 8, 15 and 40 gallon Pony or change can Mixers.

Mills and Pulverizers

Mead Pony and No. 2; Schultz - O'Neil 20"and 22"; Straub-Hammermill 50 to 1000 lbs. capacity; Jay-Bee Hammermill No. 3 Junior.

Ointment Mills

Day, Stokes and other makes; 12", 14", 18" plain and water-cooled.

Percolators

Copper — Vacuum — 200-300 lbs. capacity; Pfaudler Blue enamel, 3 x 5 with stands and ratchet tilting device.

Miscellaneous

Dryers, Kettles, Conveyors, Conveying Tables, Rinsers, etc. All equipment bearing the full unconditional F.M.C. Guaranty.

F M C

FIRST MACHINERY CORP.
419 LAFAYETTE STREET
New York City • GRamercy 7-6622

FOR SALE

8—Stokes & Smith double unit Automatic Powder Fillers with conveyors.
2—Filler Machine Co. 4 and 5 spout Fillers with non-rising tables.
2—Hobart Mixers—20 and 80 quart.
2—1000 gal. Glass lined Vacuum Pans with condensers and vacuum pump.
1—World rotary automatic Jar Labeler.
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20 to 300 gal. capacity.

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MATERIALS FOR THE FOOD MANUFACTURER

DIRECTORY

PRODUCT	CARD NUMBER	PAGE
Albumen	6	
Alcohol		33
Ammonium Phosphate	2	
Butter Flavor	5	
Calcium Phosphate	2	
Citric Acid		51
Colors	1, 4	
Corn Starch	6	
Coumarin	2	
Cream Tartar		51
Dextrines	6	
Dry Essence of Spices	4	
Egg Albumen	6	
Egg Yolk	6	
Essential Oils	1, 2	
Flavors	1, 2, 4, 5	
Granulated Tapioca	6	
Methyl Salicylate	2	
Pearl Tapioca	6	
Phosphates	2	
Phosphoric Acid	2	
Rice Flour	6	
Saccharin	2	
Salt		51
Sodium Acid Pyrophosphate	2	
Sodium Benzoate	2	
Sodium Citrate		51
Sodium Phosphate	2	
Soya Bean Flour	6	
Spice Essential Oils	1	
Tapioca Flour	6	
Tartaric Acid		51
Vanillin	2	

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replace spices effectively

in—

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Pickles
Catsup
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Condiments
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Vanillin Monsanto
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FOOD PRODUCTS SPECIALTIES

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For condimentation of all food products
Also a complete line of
FLAVORING MATERIALS

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Made entirely from extractions of grain, "Ferbo D" has achieved world-wide distinction for producing luxurious taste in the preparation of food stuffs. An unequalled business builder when used to flavor Syrups, Ice Cream and Icings, Creams, Fillings, Toppings, Candy, Fruit Cakes, Cocoa, Chocolate and Milk Products, etc., etc. Guaranteed absolutely pure and wholesome and made in strict conformity with all Federal and State Food Laws. Write for details.

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6

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Egg Albumen
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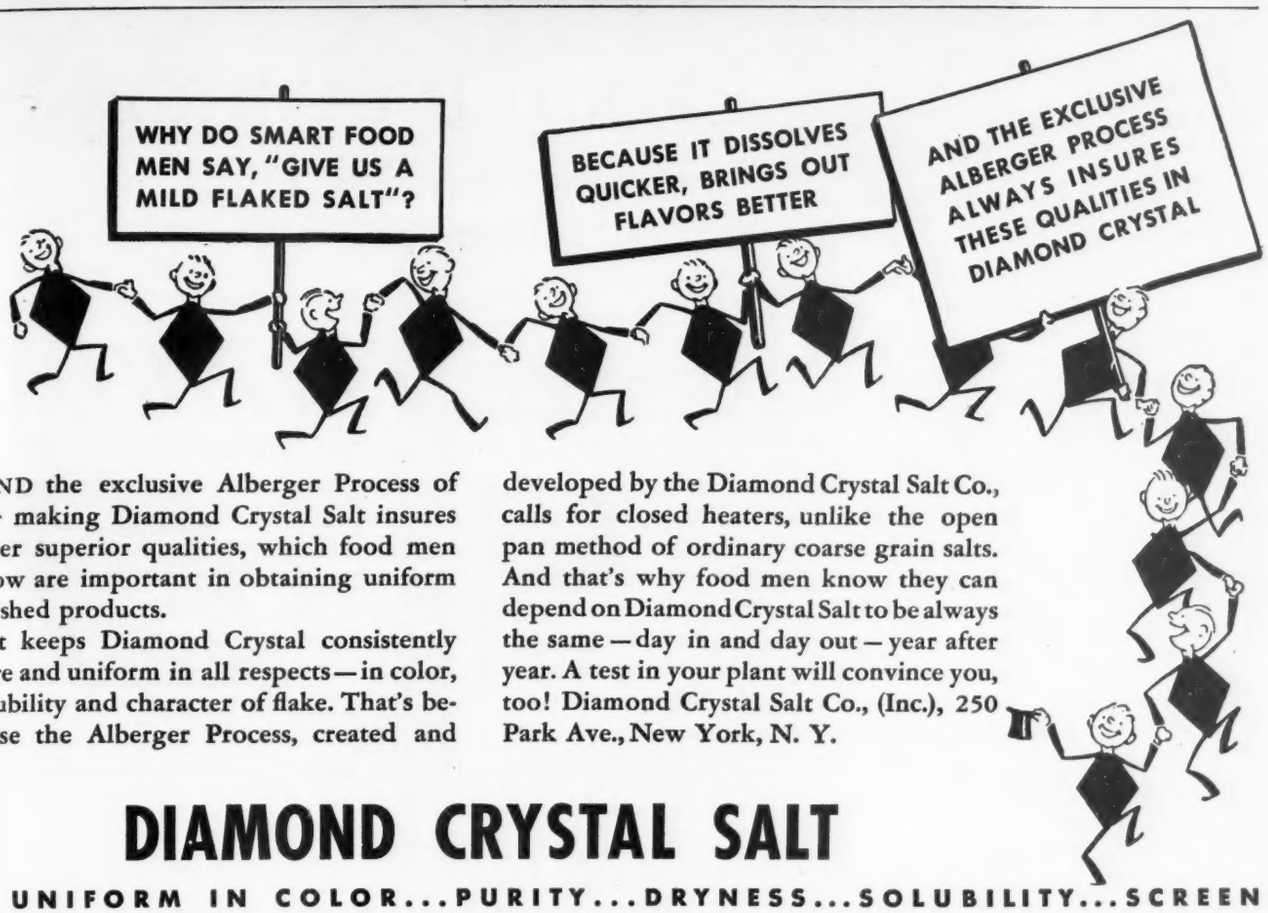
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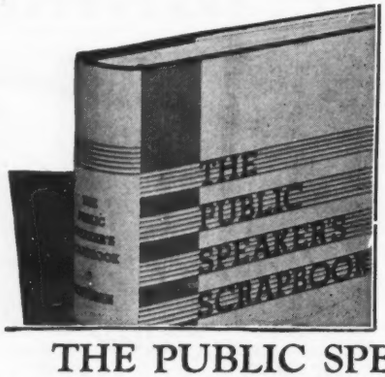

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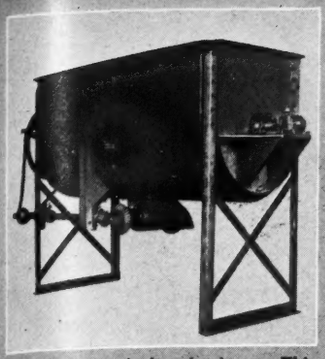
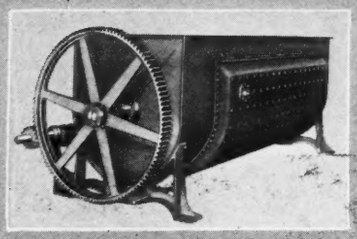
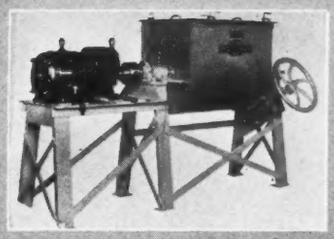


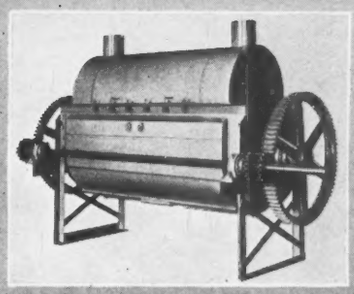
All steel steam jacketed mixers. This one with special discharge for filling cans direct from mixer.



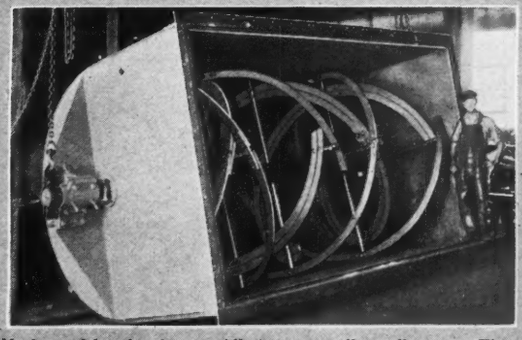
Another type-steam jacketed, used for dry powders, semi-liquids and liquids.



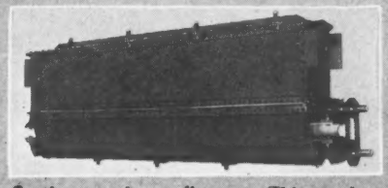
Tilt type mixers. Facilitates cleaning and discharging. Particularly well suited to many materials.



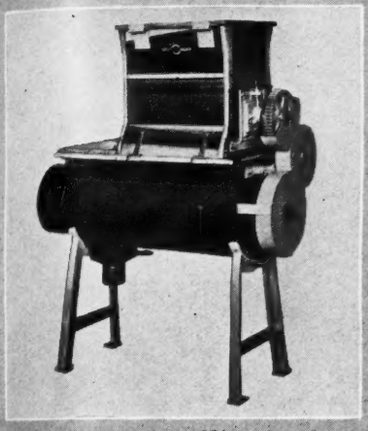
Still another type steam jacketed mixer. This one equipped with special vented hood.



Horizontal batch mixers. All sizes, as well as all types. This one of largest—550 cu. ft.



Continuous mixers, all types. This one has double action.

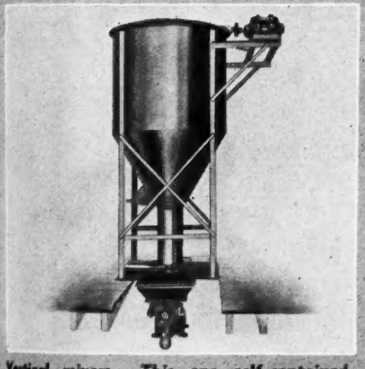


This one, one of smallest—3½ cu. ft.—shown with brush sifter to break up lumps, etc.

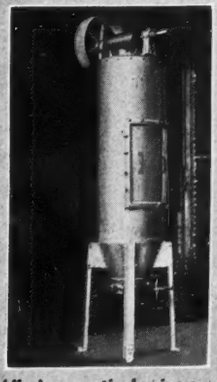
AMERICA'S MOST DIVERSIFIED LINE OF MIXERS

A Sprout-Waldron recommendation is made only after consideration of the adaptability to the individual problem of each type machine shown on this page, as well as others not shown. Result: a guarantee of accurate blending, economical operation, least possible first cost and smallest floor space requirement. An inquiry can very possibly mean greater profits and more sales—it never obligates.

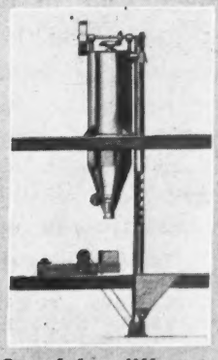
Vertical liquid mixers, jacketed. Those illustrated specially built for cellulose plant.



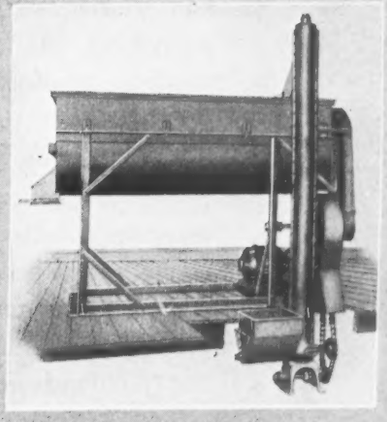
Vertical mixers. This one self-contained (loads, mixes, sacks). Has many advantages for average work.



All sizes vertical mixers. This one of smallest, self-cleaning.

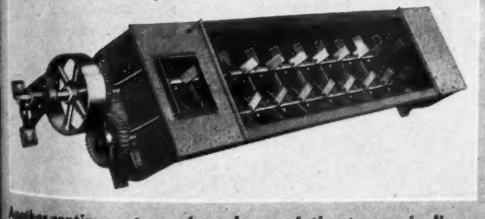


One of four different types of vertical mixers, requiring little floor space, small power.

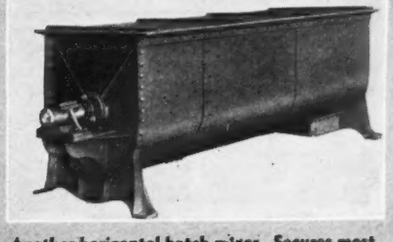


Self-contained horizontal batch mixer—loads, mixes, sacks.

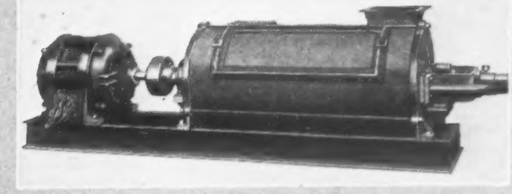
Another type batch horizontal mixer. This one all steel, available with five different styles of agitator.



Another continuous type mixer. Insures intimate co-mingling while conveying. Has many applications.



Another horizontal batch mixer. Secures most intimate blends of all dry materials, also applicable to many liquid and semi-liquid requirements.



Mixers for blending viscous liquids with dry materials, continuous principle.

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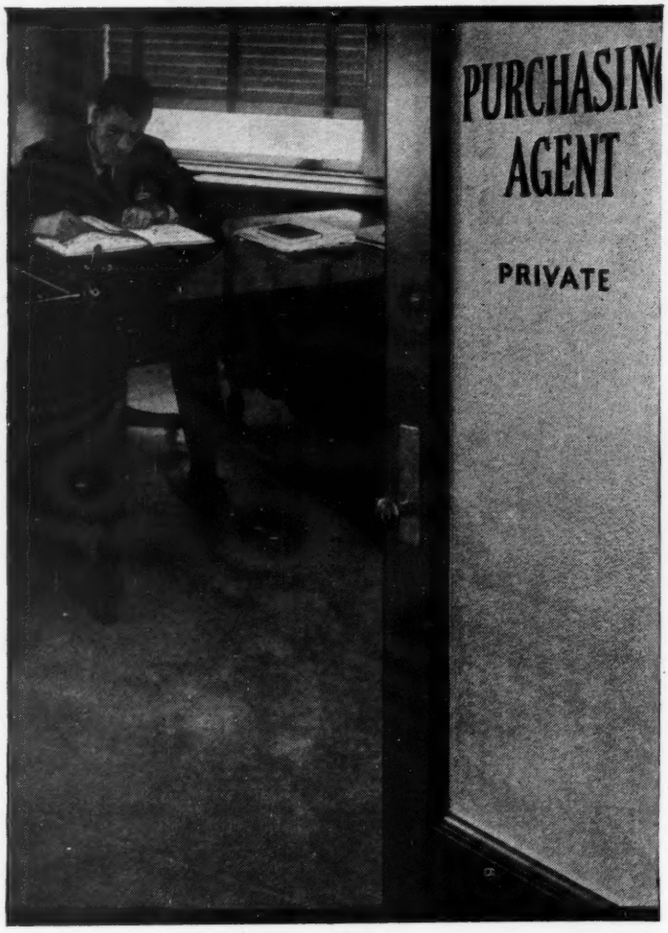

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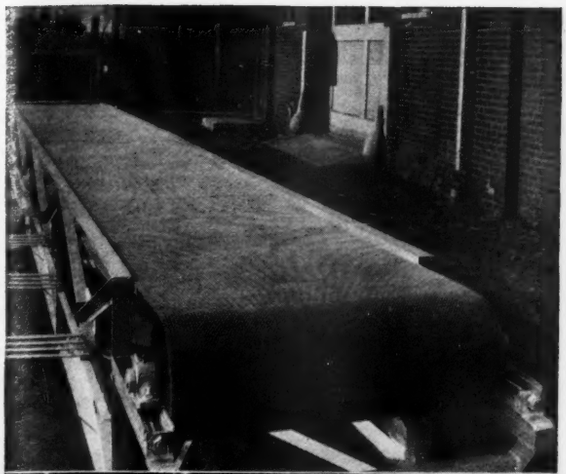

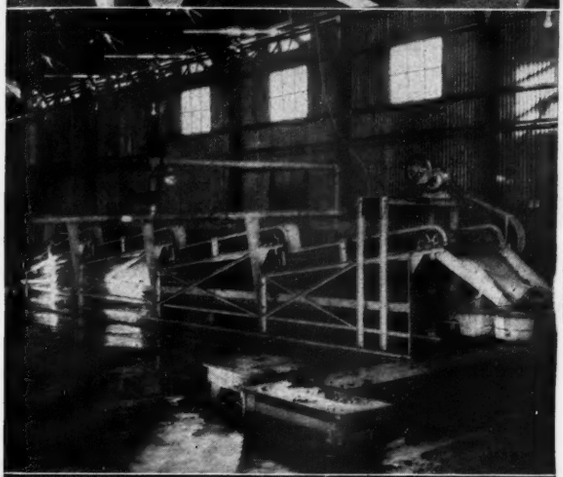

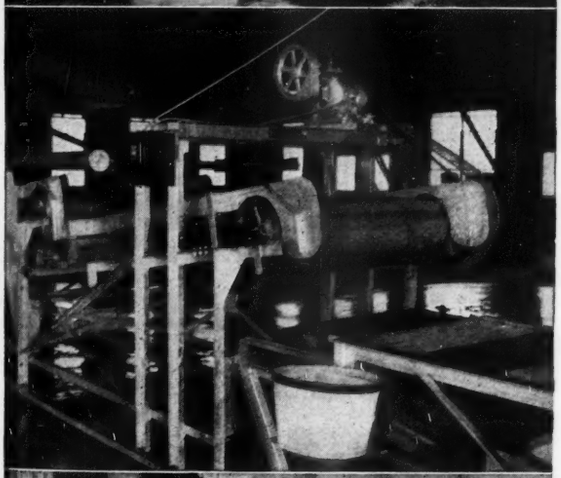

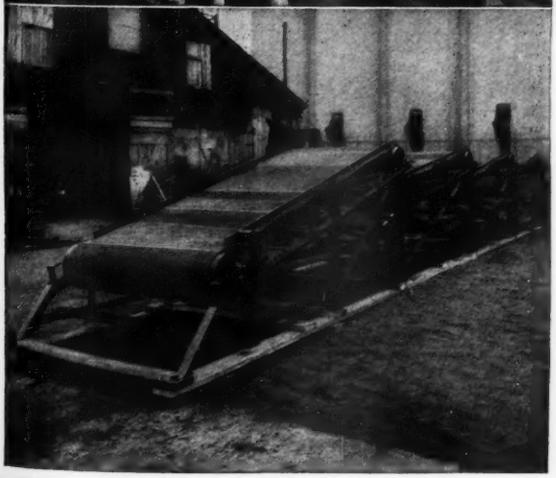

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See Chemical Engineering Catalog, 1935 Edition, Pages 153 to 160

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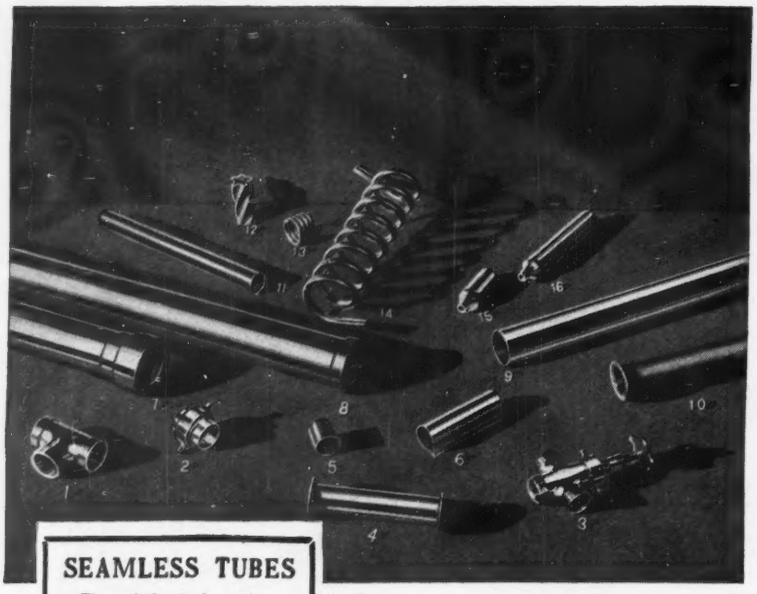

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15-18 Straight Chromium
27% Chromium
27% Chromium — 4% Nickel—1½% Molybdenum.

GLOBE Stainless Tubes are ideal wherever food is processed—made of 18-8 stainless steel found to be the best metal for this purpose. GLOBE Stainless Steel Tubes are not affected by any food acids. Polished finish for greatest sanitation.

We are equipped to handle bending and forming operations of all types, samples of which are illustrated here. Write today for details and prices.

GLOBE STAINLESS TUBE CO.

Pioneers in the Manufacture of Stainless Seamless Tubes for the Food, Chemical, Paper and Oil Industries.

168-M

Address Dept. F MILWAUKEE, WISCONSIN

OUTSTANDING IN ADVANTAGES • • •

●Canners are using La Porte Belts on sorting tables, scalders, washers, cookers, exhausters, elevators, etc. Bakers, beverage makers, meat packers and other food manufacturers are profiting through La Porte Conveyor Belts.

. . . Find out now how you can get dependable conveying service for your food needs with La Porte Sanitary Flexible Steel Conveyors. La Porte performance includes, maximum in sanitation, reduced costs, and long time service regardless of the handling need. Has square mesh, no-stretch construction, corrosion-, acid-, and heat-resisting.

● LA PORTE FLEXIBLE LONG WEARING STEEL CONVEYOR BELTS

• • • THIS BELTING CAN SAVE YOU MONEY

● *Send for Bulletin*

LA PORTE MAT AND MANUFACTURING CO.
LA PORTE INDIANA

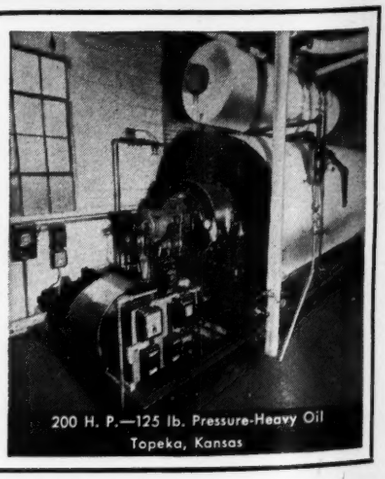
Generate steam the CLEAN way

COMPACT—NO STACK—FAST STEAMING

★

Oilbilt
STEAM GENERATING PLANTS
"The Modern Plant"

Four pass, down draft, controlled air for complete combustion. Designed for burning oil. No expensive stack or breeching. Quickly installed. Small space required. Sizes 20-500 H.P. Write today for catalog and prices.



200 H. P.—125 lb. Pressure-Heavy Oil
Topeka, Kansas

CLEAVER-BROOKS CO., Dept. B, 129 W. Wells St., Milwaukee, Wis.
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Powell Bronze, Iron And Steel Valves For Every Service

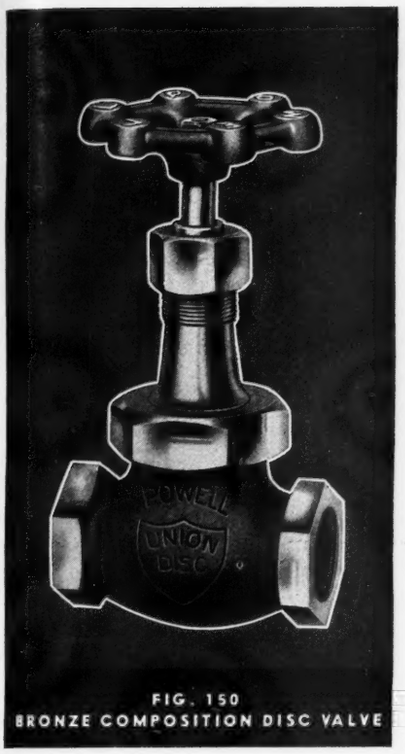
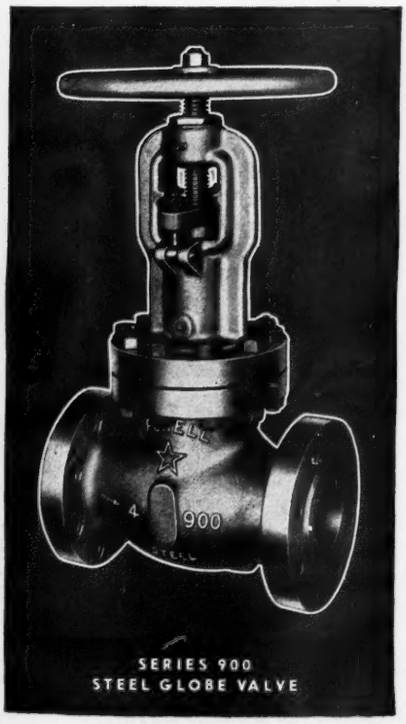


FIG. 150
BRONZE COMPOSITION DISC VALVE

FIG. 102
BRONZE GLOBE VALVE

Powell Valves — redesigned and modernized for present day trends, mounting pressures and temperatures — are available in alloy bronzes, high test cast iron, carbon or alloy steels, and other improved materials...A complete line of Powell gate, globe, angle, check, safety, and Y valves for various pressures and temperatures offers a solution for your valve needs.



SERIES 900
STEEL GLOBE VALVE

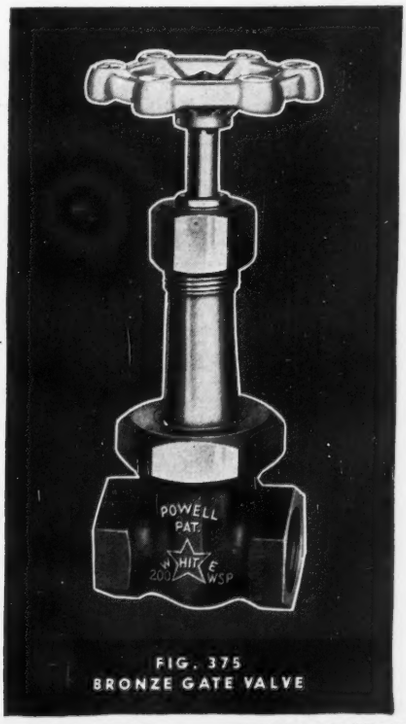


FIG. 375
BRONZE GATE VALVE

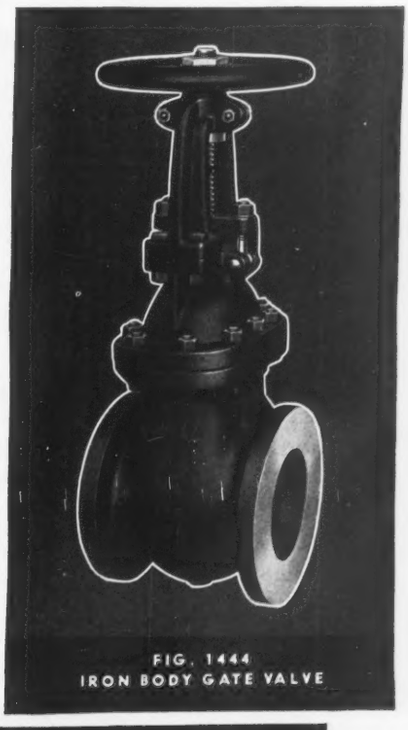
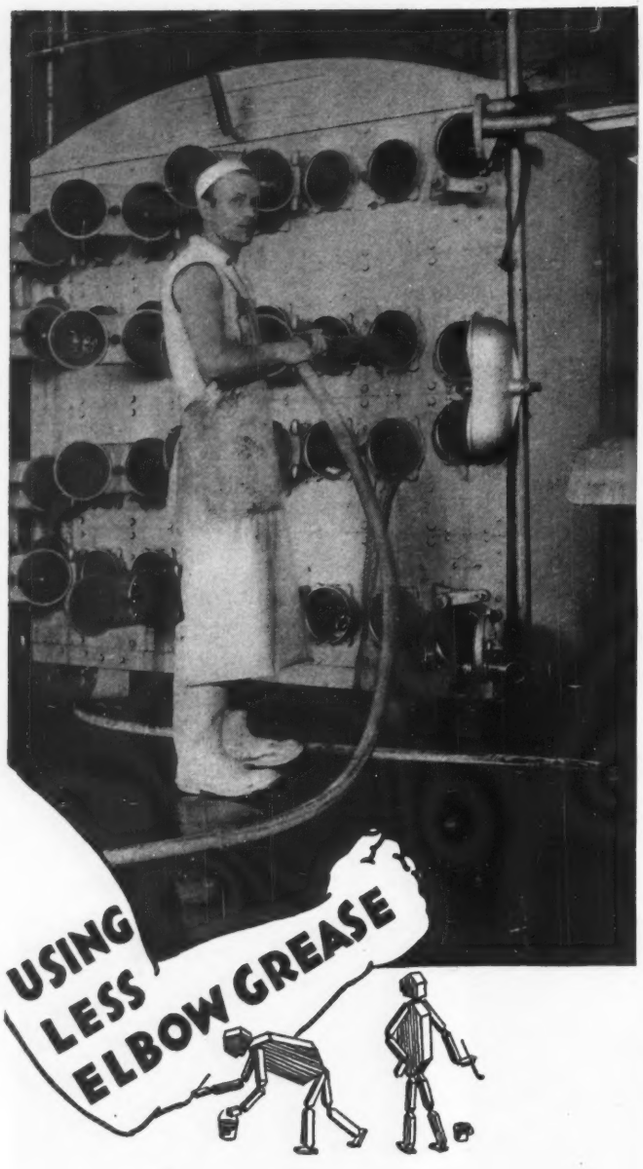


FIG. 1444
IRON BODY GATE VALVE

POWELL VALVES

THE WM. POWELL CO. CINCINNATI, OHIO



Is YOUR cleaning compound a "slow poke"? Know the double-quick action with Metso, sodium metasilicate.

The extra alkaline energy in Metso cuts through grease films without delay, speeding up all cleaning operations. One plant has cut an hour in cleaning just one piece of equipment. Everywhere Metso users report time savings.

At no extra cost, Metso also protects sensitive surfaces that other cleaners etch and spangle. May we demonstrate in your plant the speed and safety of Metso? Send for a two-pound sample to try out.

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General Offices and Laboratory: 125 S. Third St., Philadelphia, Pa.
Chicago Sales Office: Engineering Bldg. Stocks in 60 cities.
Sold in Canada by National Silicates Ltd., Toronto, Ontario.

METSO QUICK, THOROUGH **CLEANERS** CLEANING AT LOWER COST
REG. U.S. PAT. OFF.

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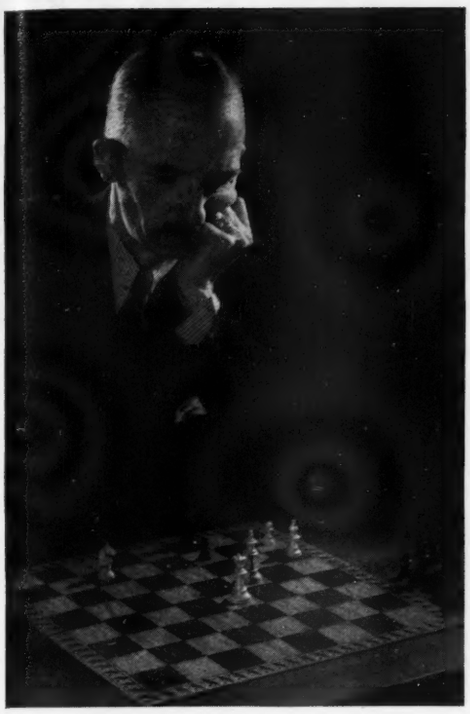


YALE

Are you *Checkmated by* WASTE?

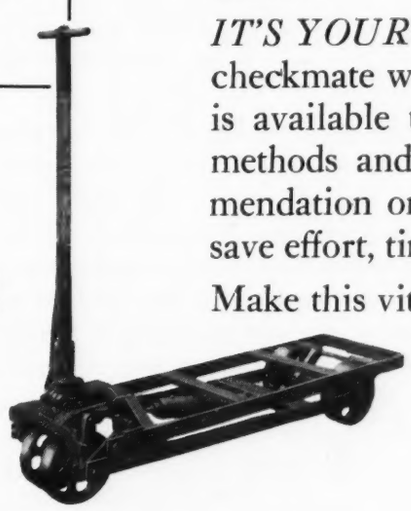
TIME is not important to the chess player — to business management TIME is all-important.

The King of Time-eaters is obsolete, inefficient, and costly methods of handling materials.

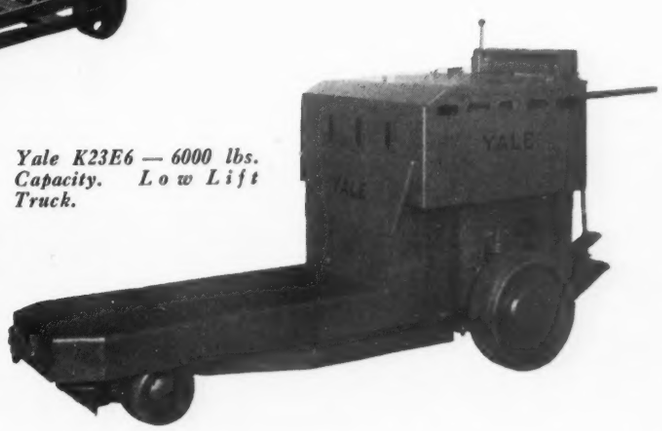
IT'S YOUR MOVE — YALE methods will checkmate waste—A Yale handling engineer is available to study your present handling methods and equipment, and give a recommendation on how to checkmate WASTE—save effort, time, and money.

Make this vital move today. Write to

Makers of Yale Electric Trucks, Hand Lift Trucks and Skid Platforms, Hand Chain Hoists, Electric Hoists, and Trolleys.



The "Blue Streak" Hand Lift Truck. Capacity 2500 lbs.



Yale K23E6 — 6000 lbs. Capacity. Low Lift Truck.

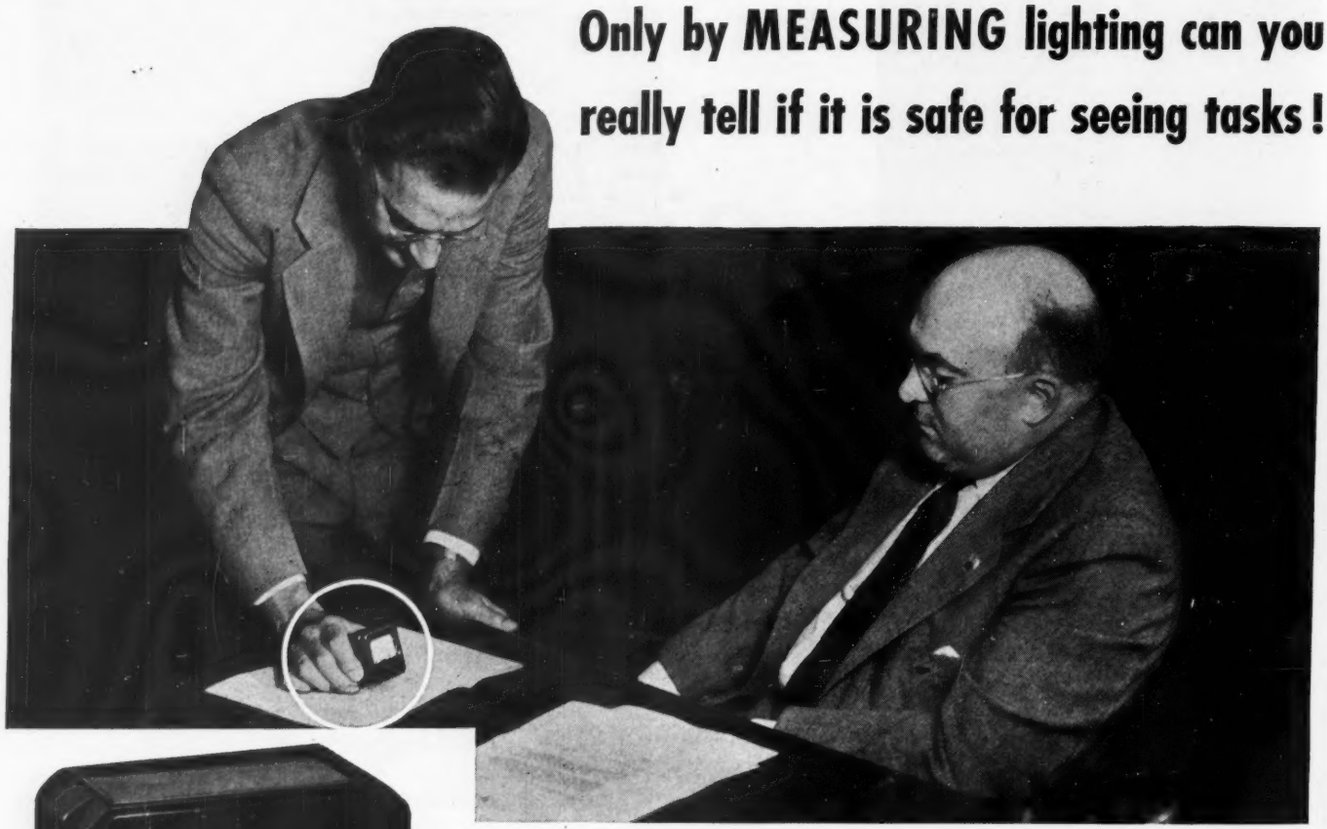
THE YALE & TOWNE MFG. COMPANY

Philadelphia Division

Philadelphia, Pa., U. S. A.

DON'T BELIEVE YOUR EYES

Only by MEASURING lighting can you really tell if it is safe for seeing tasks!



With the new Light Meter you can easily measure the lighting in your offices and tell whether they are receiving adequate light for different kinds of seeing tasks.

NEW, COMPACT LIGHT METER

Made by General Electric
Sells for only $11.50

● This new General Electric Light Meter is so conveniently small that it's easily carried in a vest pocket . . . or the change pocket of a coat. It is ruggedly made and sells for only $11.50.

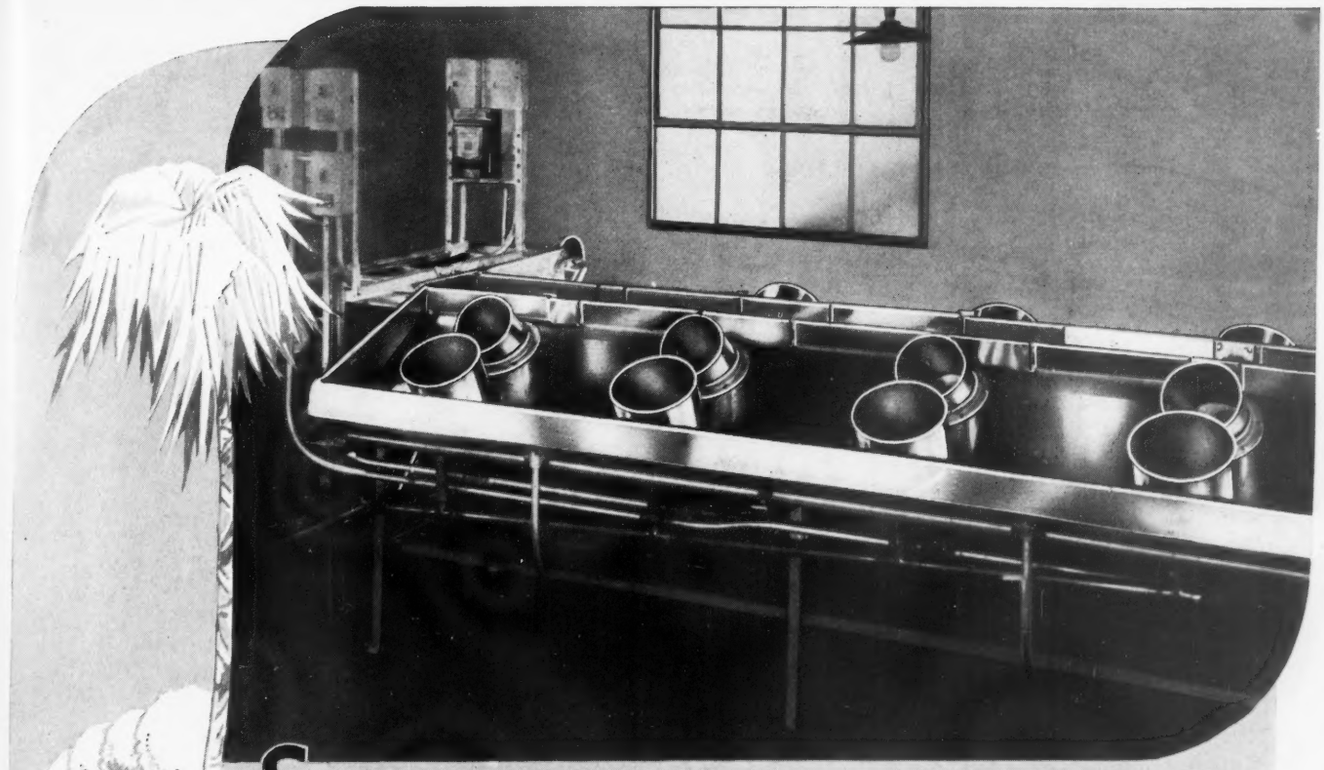
Its shape resembles a small, thin desk clock . . . 2¼ inches square and 1⅛ inches thick. As indicated in the photograph, the face of the meter has a rectangular shaped scale . . . with a range from 0 to 75 foot-candles. On the back of the meter, a stenciled metal plate shows recommended minimum foot-candle values for different seeing tasks.

● THE human eye is actually a very poor judge of lighting for seeing . . . especially for close seeing. It can *see* in light that is far too dim for *easy*, safe seeing.

Now you can easily tell whether your plant . . . and particularly those departments where close seeing work is done . . . is adequately lighted for safe seeing. The new, compact, General Electric Light Meter readily *measures* light with accuracy. It not only shows how much light is being received but also indicates the minimum required foot-candles for different seeing tasks. In the interest of better, more efficient work and greater plant cleanliness and safety, you owe it to yourself, to your business associates, and to your employees to be sure that eyes are receiving adequate light for today's close-seeing tasks. One or more of these new G. E. Light Meters should be in every plant in the food industry.

Your electric service company will be glad to make a lighting check-up in your plant, specifying safe-seeing lighting. Or write to General Electric Company, Department 166, Nela Park, Cleveland, Ohio.

EDISON MAZDA LAMPS
GENERAL ELECTRIC
They stay brighter longer



STAINLESS STEEL EQUIPMENT
VERY SOON PAYS FOR ITSELF

STAINLESS STEEL is "worth the difference." It prevents contamination and discoloration, and is highly resistant to chemical action in the preparation of foods. It is easy to keep clean, beautiful and attractive, and is strong and durable where these qualities are needed.

USS STAINLESS STEEL
SHEETS AND LIGHT PLATES

Give new substance to the old proverb, "the best is the cheapest." These sheets embody the utmost quality that science and skill can produce, and the demand for them has steadily increased. In your plant, see that U S S STAINLESS Steel Sheets and Light Plates are utilized for utensils, equipment and parts, and you will improve your products — and lower the costs of care and maintenance. Write for full information and latest literature to the companies named below:

U S S Chromium-Nickel Steels are produced under licenses of Chemical Foundation, Inc., New York; and Fried. Krupp A. G. of Germany.

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NATIONAL TUBE COMPANY, *Pittsburgh* - - - - - - - - - - - - - - PIPE AND TUBULAR PRODUCTS
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USS STAINLESS
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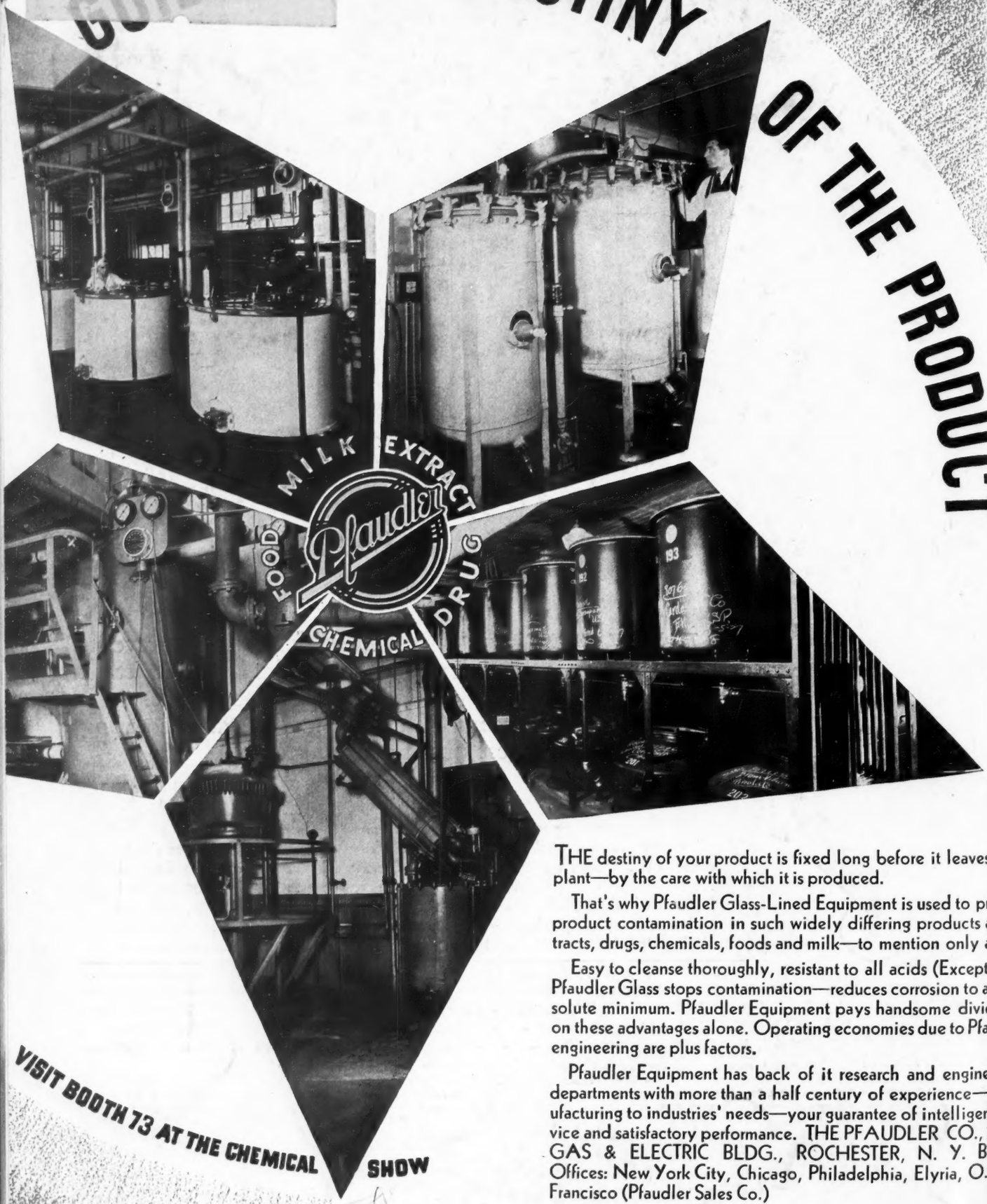
THE DESTINY OF THE PRODUCT



THE destiny of your product is fixed long before it leaves your plant—by the care with which it is produced.

That's why Pfaudler Glass-Lined Equipment is used to prevent product contamination in such widely differing products as extracts, drugs, chemicals, foods and milk—to mention only a few.

Easy to cleanse thoroughly, resistant to all acids (Except HF), Pfaudler Glass stops contamination—reduces corrosion to an absolute minimum. Pfaudler Equipment pays handsome dividends on these advantages alone. Operating economies due to Pfaudler engineering are plus factors.

Pfaudler Equipment has back of it research and engineering departments with more than a half century of experience—manufacturing to industries' needs—your guarantee of intelligent service and satisfactory performance. THE PFAUDLER CO., 1510 GAS & ELECTRIC BLDG., ROCHESTER, N. Y. Branch Offices: New York City, Chicago, Philadelphia, Elyria, O., San Francisco (Pfaudler Sales Co.)

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